MITSUBISHI
ELECTRIC

MOTION CONTROLLERS

Changes for the Better

MOTION CONTROLLER

Q series

SV13/SV22 (Motion SFC)

Q173CPU(N)

Q172CPU(N)

Programming Manual

● SAFETY PRECAUTIONS ●

(Please read these instructions before using this equipment.)

Before using this product, please read this manual and the relevant manuals introduced in this manual carefully and pay full attention to safety to handle the product correctly.
These precautions apply only to this product. Refer to the Q173CPU(N)/Q172CPU(N) Users manual for a description of the Motion controller safety precautions.
In this manual, the safety instructions are ranked as "DANGER" and "CAUTION".

⚠DANGER	Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
⚠CAUTION	Indicates that incorrect handling may cause hazardous conditions, resulting in medium or slight personal injury or physical damage.

Depending on circumstances, procedures indicated by ⚠ CAUTION may also be linked to serious results.
In any case, it is important to follow the directions for usage.

Please save this manual to make it accessible when required and always forward it to the end user.

For Safe Operations

1. Prevention of electric shocks

⚠DANGER

- Never open the front case or terminal covers while the power is ON or the unit is running, as this may lead to electric shocks.
- Never run the unit with the front case or terminal cover removed. The high voltage terminal and charged sections will be exposed and may lead to electric shocks.
- Never open the front case or terminal cover at times other than wiring work or periodic inspections even if the power is OFF. The insides of the Motion controller and servo amplifier are charged and may lead to electric shocks.
- Completely turn off the externally supplied power used in the system before mounting or removing the module, performing wiring work, or inspections. Failing to do so may lead to electric shocks.
- When performing wiring work or inspections, turn the power OFF, wait at least ten minutes, and then check the voltage with a tester, etc. Failing to do so may lead to electric shocks.
- Be sure to ground the Motion controller, servo amplifier and servomotor. (Ground resistance : 100 Ω or less) Do not ground commonly with other devices.
- The wiring work and inspections must be done by a qualified technician.
- Wire the units after installing the Motion controller, servo amplifier and servomotor. Failing to do so may lead to electric shocks or damage.
- Never operate the switches with wet hands, as this may lead to electric shocks.
- Do not damage, apply excessive stress, place heavy things on or sandwich the cables, as this may lead to electric shocks.
- Do not touch the Motion controller, servo amplifier or servomotor terminal blocks while the power is ON, as this may lead to electric shocks.
- Do not touch the built-in power supply, built-in grounding or signal wires of the Motion controller and servo amplifier, as this may lead to electric shocks.

2. For fire prevention

⚠CAUTION

- Install the Motion controller, servo amplifier, servomotor and regenerative resistor on incombustible. Installing them directly or close to combustibles will lead to fire.
- If a fault occurs in the Motion controller or servo amplifier, shut the power OFF at the servo amplifier's power source. If a large current continues to flow, fire may occur.
- When using a regenerative resistor, shut the power OFF with an error signal. The regenerative resistor may abnormally overheat due to a fault in the regenerative transistor, etc., and may lead to fire.
- Always take heat measures such as flame proofing for the inside of the control panel where the servo amplifier or regenerative resistor is installed and for the wires used. Failing to do so may lead to fire.
- Do not damage, apply excessive stress, place heavy things on or sandwich the cables, as this may lead to fire.

3. For injury prevention

⚠CAUTION

- ● Do not apply a voltage other than that specified in the instruction manual on any terminal. Doing so may lead to destruction or damage.
- ● Do not mistake the terminal connections, as this may lead to destruction or damage.
- ● Do not mistake the polarity (+ / -), as this may lead to destruction or damage.
- ● Do not touch the heat radiating fins of controller or servo amplifier, regenerative resistor and servomotor, etc., while the power is ON and for a short time after the power is turned OFF. In this timing, these parts become very hot and may lead to burns.
- ● Always turn the power OFF before touching the servomotor shaft or coupled machines, as these parts may lead to injuries.
- ● Do not go near the machine during test operations or during operations such as teaching. Doing so may lead to injuries.

4. Various precautions

Strictly observe the following precautions.

Mistaken handling of the unit may lead to faults, injuries or electric shocks.

(1) System structure

⚠CAUTION

- ● Always install a leakage breaker on the Motion controller and servo amplifier power source.
- ● If installation of an electromagnetic contactor for power shut off during an error, etc., is specified in the instruction manual for the servo amplifier, etc., always install the electromagnetic contactor.
- ● Install the emergency stop circuit externally so that the operation can be stopped immediately and the power shut off.
- ● Use the Motion controller, servo amplifier, servomotor and regenerative resistor with the correct combinations listed in the instruction manual. Other combinations may lead to fire or faults.
- ● Use the Motion controller, base unit and motion module with the correct combinations listed in the instruction manual. Other combinations may lead to faults.
- ● If safety standards (ex., robot safety rules, etc.,) apply to the system using the Motion controller, servo amplifier and servomotor, make sure that the safety standards are satisfied.
- ● Construct a safety circuit externally of the Motion controller or servo amplifier if the abnormal operation of the Motion controller or servo amplifier differ from the safety directive operation in the system.
- ● In systems where coasting of the servomotor will be a problem during the forced stop, emergency stop, servo OFF or power supply OFF, use dynamic brakes.
- ● Make sure that the system considers the coasting amount even when using dynamic brakes.
- ● In systems where perpendicular shaft dropping may be a problem during the forced stop, emergency stop, servo OFF or power supply OFF, use both dynamic brakes and electromagnetic brakes.

⚠CAUTION

- ● The dynamic brakes must be used only on errors that cause the forced stop, emergency stop, or servo OFF. These brakes must not be used for normal braking.
- ● The brakes (electromagnetic brakes) assembled into the servomotor are for holding applications, and must not be used for normal braking.
- ● The system must have a mechanical allowance so that the machine itself can stop even if the stroke limits switch is passed through at the max. speed.
- ● Use wires and cables that have a wire diameter, heat resistance and bending resistance compatible with the system.
- ● Use wires and cables within the length of the range described in the instruction manual.
- ● The ratings and characteristics of the parts (other than Motion controller, servo amplifier and servomotor) used in a system must be compatible with the Motion controller, servo amplifier and servomotor.
- ● Install a cover on the shaft so that the rotary parts of the servomotor are not touched during operation.
- ● There may be some cases where holding by the electromagnetic brakes is not possible due to the life or mechanical structure (when the ball screw and servomotor are connected with a timing belt, etc.). Install a stopping device to ensure safety on the machine side.

(2) Parameter settings and programming

⚠CAUTION

- ● Set the parameter values to those that are compatible with the Motion controller, servo amplifier, servomotor and regenerative resistor model and the system application. The protective functions may not function if the settings are incorrect.
- ● The regenerative resistor model and capacity parameters must be set to values that conform to the operation mode, servo amplifier and servo power supply module. The protective functions may not function if the settings are incorrect.
- ● Set the mechanical brake output and dynamic brake output validity parameters to values that are compatible with the system application. The protective functions may not function if the settings are incorrect.
- ● Set the stroke limit input validity parameter to a value that is compatible with the system application. The protective functions may not function if the setting is incorrect.
- ● Set the servomotor encoder type (increment, absolute position type, etc.) parameter to a value that is compatible with the system application. The protective functions may not function if the setting is incorrect.
- ● Set the servomotor capacity and type (standard, low-inertia, flat, etc.) parameter to values that are compatible with the system application. The protective functions may not function if the settings are incorrect.
- ● Set the servo amplifier capacity and type parameters to values that are compatible with the system application. The protective functions may not function if the settings are incorrect.
- ● Use the program commands for the program with the conditions specified in the instruction manual.

⚠CAUTION

- ● Set the sequence function program capacity setting, device capacity, latch validity range, I/O assignment setting, and validity of continuous operation during error detection to values that are compatible with the system application. The protective functions may not function if the settings are incorrect.
- ● Some devices used in the program have fixed applications, so use these with the conditions specified in the instruction manual.
- ● The input devices and data registers assigned to the link will hold the data previous to when communication is terminated by an error, etc. Thus, an error correspondence interlock program specified in the instruction manual must be used.
- ● Use the interlock program specified in the intelligent function module's instruction manual for the program corresponding to the intelligent function module.

(3) Transportation and installation

⚠CAUTION

- ● Transport the product with the correct method according to the mass.
- ● Use the servomotor suspension bolts only for the transportation of the servomotor. Do not transport the servomotor with machine installed on it.
- ● Do not stack products past the limit.
- ● When transporting the Motion controller or servo amplifier, never hold the connected wires or cables.
- ● When transporting the servomotor, never hold the cables, shaft or detector.
- ● When transporting the Motion controller or servo amplifier, never hold the front case as it may fall off.
- ● When transporting, installing or removing the Motion controller or servo amplifier, never hold the edges.
- ● Install the unit according to the instruction manual in a place where the mass can be withstood.
- ● Do not get on or place heavy objects on the product.
- ● Always observe the installation direction.
- ● Keep the designated clearance between the Motion controller or servo amplifier and control panel inner surface or the Motion controller and servo amplifier, Motion controller or servo amplifier and other devices.
- ● Do not install or operate Motion controller, servo amplifiers or servomotors that are damaged or that have missing parts.
- ● Do not block the intake/outtake ports of the Motion controller, servo amplifier and servomotor with cooling fan.
- ● Do not allow conductive matter such as screw or cutting chips or combustible matter such as oil enter the Motion controller, servo amplifier or servomotor.
- ● The Motion controller, servo amplifier and servomotor are precision machines, so do not drop or apply strong impacts on them.
- ● Securely fix the Motion controller, servo amplifier and servomotor to the machine according to the instruction manual. If the fixing is insufficient, these may come off during operation.

⚠CAUTION

- ● Always install the servomotor with reduction gears in the designated direction. Failing to do so may lead to oil leaks.
- ● Store and use the unit in the following environmental conditions.

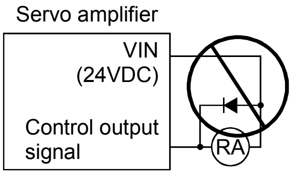
Environment	Conditions	
	Motion controller/Servo amplifier	Servomotor
Ambient temperature	According to each instruction manual.	0°C to +40°C (With no freezing) (32°F to +104°F)
Ambient humidity	According to each instruction manual.	80% RH or less (With no dew condensation)
Storage temperature	According to each instruction manual.	-20°C to +65°C (-4°F to +149°F)
Atmosphere	Indoors (where not subject to direct sunlight). No corrosive gases, flammable gases, oil mist or dust must exist	
Altitude	1000m (3280.84ft.) or less above sea level	
Vibration	According to each instruction manual	

- ● When coupling with the synchronous encoder or servomotor shaft end, do not apply impact such as by hitting with a hammer. Doing so may lead to detector damage.
- ● Do not apply a load larger than the tolerable load onto the synchronous encoder and servomotor shaft. Doing so may lead to shaft breakage.
- ● When not using the module for a long time, disconnect the power line from the Motion controller or servo amplifier.
- ● Place the Motion controller and servo amplifier in static electricity preventing vinyl bags and store.
- ● When storing for a long time, please contact with our sales representative.
  Also, execute a trial operation.

(4) Wiring

⚠CAUTION

- ● Correctly and securely wire the wires. Reconfirm the connections for mistakes and the terminal screws for tightness after wiring. Failing to do so may lead to run away of the servomotor.
- ● After wiring, install the protective covers such as the terminal covers to the original positions.
- ● Do not install a phase advancing capacitor, surge absorber or radio noise filter (option FR-BIF) on the output side of the servo amplifier.
- ● Correctly connect the output side (terminal U, V, W) and ground. Incorrect connections will lead the servomotor to operate abnormally.
- ● Do not connect a commercial power supply to the servomotor, as this may lead to trouble.
- ● Do not mistake the direction of the surge absorbing diode installed on the DC relay for the control signal output of brake signals, etc. Incorrect installation may lead to signals not being output when trouble occurs or the protective functions not functioning.



- ● Do not connect or disconnect the connection cables between each unit, the encoder cable or PLC expansion cable while the power is ON.
- ● Securely tighten the cable connector fixing screws and fixing mechanisms. Insufficient fixing may lead to the cables combing off during operation.
- ● Do not bundle the power line or cables.

(5) Trial operation and adjustment

⚠CAUTION

- ● Confirm and adjust the program and each parameter before operation. Unpredictable movements may occur depending on the machine.
- ● Extreme adjustments and changes may lead to unstable operation, so never make them.
- ● When using the absolute position system function, on starting up, and when the Motion controller or absolute value motor has been replaced, always perform a home position return.

(6) Usage methods

⚠CAUTION

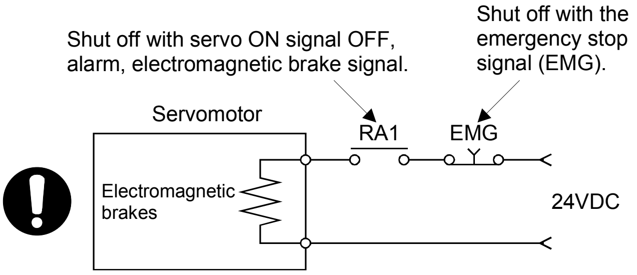
- Immediately turn OFF the power if smoke, abnormal sounds or odors are emitted from the Motion controller, servo amplifier or servomotor.
- Always execute a test operation before starting actual operations after the program or parameters have been changed or after maintenance and inspection.
- Do not attempt to disassemble and repair the units excluding a qualified technician whom our company recognized.
- Do not make any modifications to the unit.
- Keep the effect or electromagnetic obstacles to a minimum by installing a noise filter or by using wire shields, etc. Electromagnetic obstacles may affect the electronic devices used near the Motion controller or servo amplifier.
- When using the CE Mark-compliant equipment, refer to the "EMC Installation Guidelines" (data number IB(NA)-67339) for the Motion controllers and refer to the corresponding EMC guideline information for the servo amplifiers, inverters and other equipment.
- Use the units with the following conditions.

Item	Conditions
Input power	According to each instruction manual.
Input frequency	According to each instruction manual.
Tolerable momentary power failure	According to each instruction manual.

(7) Corrective actions for errors

⚠CAUTION

- If an error occurs in the self diagnosis of the Motion controller or servo amplifier, confirm the check details according to the instruction manual, and restore the operation.
- If a dangerous state is predicted in case of a power failure or product failure, use a servomotor with electromagnetic brakes or install a brake mechanism externally.
- Use a double circuit construction so that the electromagnetic brake operation circuit can be operated by emergency stop signals set externally.



- If an error occurs, remove the cause, secure the safety and then resume operation after alarm release.
- The unit may suddenly resume operation after a power failure is restored, so do not go near the machine. (Design the machine so that personal safety can be ensured even if the machine restarts suddenly.)

(8) Maintenance, inspection and part replacement

⚠CAUTION

- ● Perform the daily and periodic inspections according to the instruction manual.
- ● Perform maintenance and inspection after backing up the program and parameters for the Motion controller and servo amplifier.
- ● Do not place fingers or hands in the clearance when opening or closing any opening.
- ● Periodically replace consumable parts such as batteries according to the instruction manual.
- ● Do not touch the lead sections such as ICs or the connector contacts.
- ● Before touching the module, always touch grounded metal, etc. to discharge static electricity from human body. Failure to do so may cause the module to fail or malfunction.
- ● Do not directly touch the module's conductive parts and electronic components.
  Touching them could cause an operation failure or give damage to the module.
- ● Do not place the Motion controller or servo amplifier on metal that may cause a power leakage or wood, plastic or vinyl that may cause static electricity buildup.
- ● Do not perform a megger test (insulation resistance measurement) during inspection.
- ● When replacing the Motion controller or servo amplifier, always set the new module settings correctly.
- ● When the Motion controller or absolute value motor has been replaced, carry out a home position return operation using one of the following methods, otherwise position displacement could occur.
  1) After writing the servo data to the Motion controller using programming software, switch on the power again, then perform a home position return operation.
  2) Using the backup function of the programming software, load the data backed up before replacement.
- ● After maintenance and inspections are completed, confirm that the position detection of the absolute position detector function is correct.
- ● Do not drop or impact the battery installed to the module.
  Doing so may damage the battery, causing battery liquid to leak in the battery. Do not use the dropped or impacted battery, but dispose of it.
- ● Do not short circuit, charge, overheat, incinerate or disassemble the batteries.
- ● The electrolytic capacitor will generate gas during a fault, so do not place your face near the Motion controller or servo amplifier.
- ● The electrolytic capacitor and fan will deteriorate. Periodically replace these to prevent secondary damage from faults. Replacements can be made by our sales representative.
- ● Lock the control panel and prevent access to those who are not certified to handle or install electric equipment.
- ● Do not burn or break a module and servo amplifier. Doing so may cause a toxic gas.

(9) About processing of waste

When you discard Motion controller, servo amplifier, a battery (primary battery) and other option articles, please follow the law of each country (area).

⚠CAUTION

- ● This product is not designed or manufactured to be used in equipment or systems in situations that can affect or endanger human life.
- ● When considering this product for operation in special applications such as machinery or systems used in passenger transportation, medical, aerospace, atomic power, electric power, or submarine repeating applications, please contact your nearest Mitsubishi sales representative.
- ● Although this product was manufactured under conditions of strict quality control, you are strongly advised to install safety devices to forestall serious accidents when it is used in facilities where a breakdown in the product is likely to cause a serious accident.

(10) General cautions

- ● All drawings provided in the instruction manual show the state with the covers and safety partitions removed to explain detailed sections. When operating the product, always return the covers and partitions to the designated positions, and operate according to the instruction manual.

REVISIONS

＊ The manual number is given on the bottom left of the back cover.

Print Date	＊ Manual Number	Revision
Jun., 2002	IB(NA)-0300042-A	First edition
Feb., 2004	IB(NA)-0300042-B	[Addition model] Q173CPUN-T/Q172CPUN-T, A31TU-D3K13/A31TU-DNK13, Q172EX-S1, Q173PX-S1, Q00CPU, Q01CPU, 64AD, Q68ADV, Q68ADI, Q62DA, Q64DA, Q68DAV, Q68DAI, Q170TUD3CBL3M, Q170TUDNCBL3M, Q170TUDNCBL03M-A, Q170TUTM, A31TUD3TM, FR-V5□0-□, Software for SV43 [Addition function] For WindowsXP, Home position return function, ROM operation function, Online change function [Additional correction/partial correction] Safety precautions, About processing of waste, Startup slow of the Multiple CPU system, User file list, Error code list, etc. [partial correction]
Mar., 2006	IB(NA)-0300042-C	[Addition model] Q62P, Q172EX-S2, Q172EX-S3, Q170ENC [Addition function] Cam axis command signal, Smoothing clutch complete signal, Gain changing signal, Real mode axis information register, Motion SFC instruction "FMOV", Bit device setting by Motion SFC instruction, Security function [Additional correction/partial correction] Safety precautions, User file list, Error code list, Warranty, Manual model code (1CT781→1XB781), etc.
Apr., 2010	IB(NA)-0300042-D	[Additional correction/partial correction] Safety precautions, "1.6.1 I/O No. for I/O modules and intelligent function modules", Warranty

Japanese Manual Version IB(NA)-0300023

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INTRODUCTION

Thank you for choosing the Q173CPU(N)/Q172CPU(N) Motion Controller.
Please read this manual carefully so that equipment is used to its optimum.

CONTENTS

About Manuals

The following manuals are related to this product.

Referring to this list, please request the necessary manuals.

Related Manuals

(1) Motion controller

Manual Name	Manual Number (Model Code)
Q173CPU(N)/Q172CPU(N) Motion controller User's Manual This manual explains specifications of the Motion CPU modules, Q172LX Servo external signal interface module, Q172EX Serial absolute synchronous encoder interface module, Q173PX Manual pulse generator interface module, Teaching units, Power supply modules, Servo amplifiers, SSCNET cables, synchronous encoder cables and others. (Optional)	IB-0300040 (1XB780)
Q173CPU(N)/Q172CPU(N) Motion controller (SV13/SV22) Programming Manual (REAL MODE) This manual explains the servo parameters, positioning instructions, device list, error list and others. (Optional)	IB-0300043 (1XB782)
Q173CPU(N)/Q172CPU(N) Motion controller (SV22) Programming Manual (VIRTUAL MODE) This manual describes the dedicated instructions use to the synchronous control by virtual main shaft, mechanical system program create mechanical module. This manual explains the servo parameters, positioning instructions, device list, error list and others. (Optional)	IB-0300044 (1XB783)
Q173CPU(N)/Q172CPU(N) Motion controller (SV43) Programming Manual This manual describes the dedicated instructions to execute the positioning control by Motion program of EIA language (G-code). This manual explains the Multiple CPU system configuration, performance specifications, functions, programming, debugging, servo parameters, positioning instructions, device list error list and others. (Optional)	IB-0300070 (1CT784)

(2) PLC

Manual Name	Manual Number (Model Code)
QCPU User's Manual (Hardware Design, Maintenance and Inspection) This manual explains the specifications of the QCPU modules, power supply modules, base units, extension cables, memory card battery, and the maintenance/inspection for the system, trouble shooting, error codes and others. (Optional)	SH-080483ENG (13JR73)
Qn(H)/QnPH/QnPRHCPUCPU User's Manual (Function Explanation, Program Fundamentals) This manual explains the functions, programming methods and devices and others to create programs with the QCPU. (Optional)	SH-080808ENG (13JZ28)
QCPU User's Manual (Multiple CPU System) This manual explains Multiple CPU system overview, system configuration, I/O modules, communication between CPU modules and communication with the I/O modules or intelligent function modules. (Optional)	SH-080485ENG (13JR75)
QCPU Programming Manual (Common Instructions) This manual explains how to use the sequence instructions, basic instructions, application instructions and micro computer program. (Optional)	SH-080809ENG (13JW10)
QCPU (Q Mode)/QnACPU Programming Manual (PID Control Instructions) This manual explains the dedicated instructions used to exercise PID control. (Optional)	SH-080040 (13JF59)
QCPU (Q Mode)/QnACPU Programming Manual (SFC) This manual explains the system configuration, performance specifications, functions, programming, debugging, error codes and others of MELSAP3. (Optional)	SH-080041 (13JF60)
I/O Module Type Building Block User's Manual This manual explains the specifications of the I/O modules, connector, connector/terminal block conversion modules and others. (Optional)	SH-080042 (13JL99)

MEMO

1. OVERVIEW

1.1 Overview

This programming manual describes the Motion SFC program and Multiple CPU system of the operating system software packages "SW6RN-SV13Q□", "SW6RN-SV22Q□" for Motion CPU module(Q173CPU(N)/Q172CPU(N)).
In this manual, the following abbreviations are used.

Generic term/Abbreviation	Description
Q173CPU(N)/Q172CPU(N) or Motion CPU (module)	Q173CPUN/Q172CPUN/Q173CPUN-T/Q172CPUN-T/Q173CPU/Q172CPU Motion CPU module
Q172LX/Q172EX/Q173PX or Motion module	Q172LX Servo external signals interface module/ Q172EX(-S1/-S2/-S3) Serial absolute synchronous encoder interface module(Note-1)/ Q173PX(-S1) Manual pulse generator interface module
MR-H-BN	Servo amplifier model MR-H□BN
MR-J2□-B	Servo amplifier model MR-J2S-□B/MR-J2M-B/MR-J2-□B/MR-J2-03B5
AMP or Servo amplifier	General name for "Servo amplifier model MR-H□BN/MR-J2S-□B/MR-J2M-B/ MR-J2-□B/MR-J2-03B5, Vector inverter FREQROL-V500 series"
QCPU, PLC CPU or PLC CPU module	Qn(H)CPU
Multiple CPU system or Motion system	Abbreviation for "Multiple PLC system of the Q series"
CPUn	Abbreviation for "CPU No.n (n= 1 to 4) of the CPU module for the Multiple CPU system"
Programming software package	General name for "MT Developer" and "GX Developer"
Operating system software	General name for "SW□RN-SV□Q□"
SV13	Operating system software for conveyor assembly use (Motion SFC) : SW6RN-SV13Q□
SV22	Operating system software for automatic machinery use (Motion SFC) : SW6RN-SV22Q□
MT Developer	Abbreviation for Integrated start-up support software package "MT Developer"
GX Developer	Abbreviation for MELSEC PLC programming software package "GX Developer (Version 6 or later)"
Manual pulse generator or MR-HDP01	Abbreviation for "Manual pulse generator (MR-HDP01)"
Serial absolute synchronous encoder or MR-HENC/Q170ENC	Abbreviation for "Serial absolute synchronous encoder (MR-HENC/Q170ENC)"
SSCNET (Note-2)	High speed serial communication between Motion controller and servo amplifier
Absolute position system	General name for "System using the servomotor and servo amplifier for absolute position"
Cooling fan unit	Cooling fan unit (Q170FAN)
Dividing unit	Dividing unit (Q173DV)
Battery unit	Battery unit (Q170BAT)

Generic term/Abbreviation	Description
A□0BD-PCF	A10BD-PCF/A30BD-PCF SSC I/F board
SSC I/F communication cable	Abbreviation for "Cable for SSC I/F board/card"
Teaching Unit or A31TU-D3□/A31TU-DN□	A31TU-D3□/A31TU-DN□ Teaching unit(Note-3)
Intelligent function module	Abbreviation for "MELSECNET/H module/Ethernet module/CC-Link module/ Serial communication module"
Vector inverter (FR-V500)	Vector inverter FREQROL-V500 series

(Note-1) : Q172EX can be used in SV22.

(Note-2) : SSCNET: Servo System Controller NETwork

(Note-3) : Teaching unit can be used in SV13.

REMARK

For information about the each module, design method for program and parameter, refer to the following manuals relevant to each module.

Item		Reference Manual
Motion CPU module/Motion unit		Q173CPU(N)/Q172CPU(N) User's Manual
PLC CPU, peripheral devices for PLC program design, I/O modules and intelligent function module		Manual relevant to each module
Operation method for MT Developer		Help of each software
SV13/SV22	• Design method for positioning control program in the real mode • Design method for positioning control parameter	Q173CPU(N)/Q172CPU(N) Motion controller (SV13/SV22) Programming Manual (REAL MODE)
SV22 (Virtual mode)	• Design method for mechanical system program	Q173CPU(N)/Q172CPU(N) Motion controller (SV22) Programming Manual (VIRTUAL MODE)

1.2 Features

The Motion CPU and Multiple CPU system have the following features.

1.2.1 Features of Motion CPU

(1) Q series PLC Multiple CPU system

(a) The load of control processing for each CPU can be distributed by controlling the complicated servo control with the Motion CPU, and the machine control or information control with the PLC CPU, and flexible system configuration can be realized.

(b) The Motion CPU and PLC CPU are selected flexibly, and the Multiple CPU system up to 4 CPU modules can be realized.
The Motion CPU module for the number of axis to be used can be selected.

Q173CPU(N)	: Up to 32 axes
Q172CPU(N)	: Up to 8 axes

The PLC CPU module for the program capacity to be used can be selected.
(One or more PLC CPU is necessary with the Multiple CPU system.)

Q00CPU	: 8k steps
Q01CPU	: 14k steps
Q02CPU, Q02HCPU	: 28k steps
Q06HCPU	: 60k steps
Q12HCPU	: 124k steps
Q25HCPU	: 252k steps

(c) The device data of other CPU can be used as the device data of self CPU because the Multiple CPU automatic refresh may do automatically data giving and receiving between each CPU of the Multiple CPU system.

(d) The device data access of the Motion CPU and the Motion SFC program start can be executed from PLC CPU by the Motion dedicated PLC instruction.

(2) Programming in the Motion SFC programs

(a) Since a program intelligible for anyone can be created in flow chart form by macking a sequence of machine operation correspond to each operation step, maintenance nature improves.

(b) Since transition conditions are judged with Motion CPU side and positioning starts, there is not dispersion in the response time influenced by PLC scan time.

(c) High speed and high response processing is realizable with the step processing method (only active steps) of Motion SFC.

(d) Not only positioning control but also numerical operations, device SET/RST, etc. can be processed with Motion CPU side, making via PLC CPU is unnecessary and a tact time can be shortened.

(e) By transition condition description peculiar to Motion SFC, the instructions to servo amplifier is possible at completion of starting condition.

(f) By transition condition description peculiar to Motion SFC, after starting, transition to next step is possible without waiting for positioning completion.

(g) Motion SFC program that responds and executes it at high speed for interrupt input from external source can be set.

(h) Motion SFC program executed in the fixed cycle (0.88ms, 1.77ms, 3.55ms, 7.11ms, 14.2ms) by synchronizing to the Motion operation cycle can be set.

(3) High speed operation processing

(a) The minimum operation cycle of the Motion CPU is made 0.88[ms] (so far, the ratio of 4 times), and it correspond with high frequency operation.

(b) High speed PLC control is possible by the Q series PLC CPU.
(For LD instruction)

Q02HCPU, Q06HCPU, Q12HCPU, Q25HCPU	: 0.034[μs]
Q02CPU	: 0.079[μs]
Q00CPU	: 0.16[μs]
Q01CPU	: 0.10[μs]

(4) Connection between the Motion controller and servo amplifier with high speed serial communication by SSCNET

High speed serial communication by SSCNET connect between the Motion controller and servo amplifier, and batch control the charge of servo parameter, servo monitor and test operation, etc.
It is also realised reduce the number of wires.

(5) The operating system software package for your application needs

By installing the operating system software for applications in the internal flash memory of the Motion CPU, the Motion controller suitable for the machine can be realized.
And, it also can correspond with the function improvement of the software package.

(a) Conveyor assembly use (SV13)
Offer liner interpolation, circular interpolation, helical interpolation, constant-speed control, speed control, fixed-pitch feed and etc. by the dedicated servo instruction. Ideal for use in conveyors and assembly machines.

(b) Automatic machinery use (SV22)
Provides synchronous control and offers electronic cam control by mechanical support language. Ideal for use in automatic machinery.

(c) Machine tool peripheral use (SV43)
Offer liner interpolation, circular interpolation, helical interpolation, constant-speed positioning and etc. by the EIA language (G-code). Ideal for use in machine tool peripheral.

1.2.2 Basic specifications of Q173CPU(N)/Q172CPU(N)

(1) Module specifications

Item	Q173CPUN	Q173CPUN-T	Q173CPU	Q172CPUN	Q172CPUN-T	Q172CPU
Teaching unit	——	Usable	——	——	Usable	——
Internal current consumption(5VDC) [A]	1.25	1.56 (Note)	1.75	1.14	1.45 (Note)	1.62
Mass [kg]	0.23	0.24	0.22	0.22	0.23	0.21
Exterior dimensions [mm(inch)]	98(3.86)(H) × 27.4(1.08)(W) × 114.3(4.50)(D)		118(4.65)(H) × 27.4(1.08)(W) × 89.3(3.52)(D)	98(3.86)(H) × 27.4(1.08)(W) × 114.3(4.50)(D)		118(4.65)(H) × 27.4(1.08)(W) × 89.3(3.52)(D)

(Note) : Current consumption 0.26[A] of the teaching unit is included.

(2) SV13/SV22 Motion control specifications/performance specifications

(a) Motion control specifications

Item		Q173CPUN(-T)	Q173CPU	Q172CPUN(-T)	Q172CPU
Number of control axes		Up to 32 axes		Up to 8 axes	
Operation cycle (default)	SV13	0.88ms/ 1 to 8 axes 1.77ms/ 9 to 16 axes 3.55ms/17 to 32 axes		0.88ms/1 to 8 axes	
	SV22	0.88ms/ 1 to 4 axes 1.77ms/ 5 to 12 axes 3.55ms/13 to 24 axes 7.11ms/25 to 32 axes		0.88ms/1 to 4 axes 1.77ms/5 to 8 axes	
Interpolation functions		Linear interpolation (Up to 4 axes), Circular interpolation (2 axes), Helical interpolation (3 axes)			
Control modes		PTP(Point to Point) control, Speed control, Speed-position control, Fixed-pitch feed, Constant speed control, Position follow-up control, Speed switching control, High-speed oscillation control, Synchronous control (SV22)			
Acceleration/ deceleration control		Automatic trapezoidal acceleration/deceleration, S-curve acceleration/deceleration			
Compensation		Backlash compensation, Electronic gear			
Programming language		Motion SFC, Dedicated instruction, Mechanical support language (SV22)			
Servo program capacity		14k steps			
Number of positioning points		3200 points (Positioning data can be designated indirectly)			
Programming tool		IBM PC/AT			
Peripheral I/F		USB/RS-232/SSCNET			
Teaching operation function		Provided (Q173CPUN-T/Q172CPUN-T, SV13 use)			
Home position return function		Proximity dog type (2 types), Count type (3 types), Data set type (2 types), Dog cradle type, Stopper type (2 types), Limit switch combined type (Home position return re-try function provided, home position shift function provided)			
JOG operation function		Provided			

Motion control specifications (continued)

Item	Q173CPUN(-T)	Q173CPU	Q172CPUN(-T)	Q172CPU
Manual pulse generator operation function	Possible to connect 3 modules			
Synchronous encoder operation function	Possible to connect 12 modules		Possible to connect 8 modules	
M-code function	M-code output function provided M-code completion wait function provided			
Limit switch output function	Number of output points 32 points Watch data: Motion control data/Word device			
Absolute position system	Made compatible by setting battery to servo amplifier. (Possible to select the absolute data method or incremental method for each axis) (Note) : When the vector inverter is used, only the increment method.			
Number of SSCNET I/F	5CH (Note-1)		2CH	
Motion related interface module	Q172LX : 4 modules usable Q172EX : 6 modules usable Q173PX : 4 modules usable (Note-2)		Q172LX : 1 module usable Q172EX : 4 modules usable Q173PX : 3 modules usable (Note-2)	

(Note-1) : Use the Dividing unit(Q173DV) or dividing cable(Q173J2B△CBL□M/Q173HB△CBL□M).

(Note-2) : When using the incremental synchronous encoder (SV22 use), you can use avobe number of modules. When connecting the manual pulse generator, you can use only 1 module.

(b) Motion SFC Performance Specifications

Item				Q173CPU(N)/Q172CPU(N)
Motion SFC program capacity	Code total (Motion SFC chart+ Operation control + Transition)			287k bytes
	Text total (Operation control + Transition)			224k bytes
Motion SFC program	Number of Motion SFC programs			256 (No.0 to 255)
	Motion SFC chart size/program			Up to 64k bytes (Included Motion SFC chart comments)
	Number of Motion SFC steps/program			Up to 4094 steps
	Number of selective branches/branch			255
	Number of parallel branches/branch			255
	Parallel branch nesting			Up to 4 levels
Operation control program (F/FS) / Transition program (G)	Number of operation control programs			4096 with F(Once execution type) and FS(Scan execution type) combined. (F/FS0 to F/FS4095)
	Number of transition programs			4096(G0 to G4095)
	Code size/program			Up to approx. 64k bytes (32766 steps)
	Number of blocks(line)/program			Up to 8192 blocks (in the case of 4 steps(min)/blocks)
	Number of characters/block (line)			Up to 128 (comment included)
	Number of operand/block			Up to 64 (operand: constants, word device, bit devices)
	( ) nesting/block			Up to 32 levels
	Descriptive expression	Operation control program		Calculation expression/bit conditional expression
		Transition program		Calculation expression/bit conditional expression/ comparison conditional expression
Execute specification	Number of multi executed programs			Up to 256
	Number of multi active steps			Up to 256 steps/all programs
	Executed task	Normal task		Executed in motion main cycle
		Event task (Execution can be masked.)	Fixed cycle	Executed in fixed cycle (0.88ms, 1.77ms, 3.55ms, 7.11ms, 14.2ms)
			External interrupt	Executed when input ON is set among interrupt module QI60 (16 points).
			PLC interrupt	Executed with interrupt instruction (S(P).GINT) from PLC CPU.
		NMI task		Executed when input ON is set among interrupt module QI60 (16 points).
Number of I/O points (X/Y)				8192 points
Number of real I/O points (PX/PY)				256 points
Number of devices (Device In the Motion CPU only) (Included the positioning dedicated device)	Internal relays (M)			Total (M + L) : 8192 points
	Latch relays (L)			
	Link relays (B)			8192 points
	Annunciators (F)			2048 points
	Special relays (M)			256 points
	Data registers (D)			8192 points
	Link registers (W)			8192 points
	Special registers (D)			256 points
	Motion registers (#)			8192 points
	Coasting timers (FT)			1 point (888μs)

1.2.3 Operation control/transition control specifications

(1) Table of the operation control/transition control specifications

<table>
<tr><th>Item</th><th colspan="3">Specifications</th><th>Remark</th></tr>
<tr><td rowspan="3">Expression</td><td colspan="2">Calculation expression</td><td>Returns a numeric result.
Expressions for calculating indirectly specified data using constants and word devices.</td><td>D100+1,SIN(D100), etc.</td></tr>
<tr><td rowspan="2">Conditional expression</td><td>Bit conditional expression</td><td>Returns a true or false result.
Expression for judging ON or OFF of bit device.</td><td>M0, !M0, M1*M0, (M1+M2)*(!M3+M4), etc.</td></tr>
<tr><td>Comparison conditional expression</td><td>Expressions for comparing indirectly specified data and calculation expressions using constants and word devices.</td><td>D100==100
D10<D102+D10, etc.</td></tr>
<tr><td>Bit devices</td><td colspan="3">
<table>
<tr><th colspan="2" rowspan="2">Device</th><th rowspan="2">Symbol</th><th colspan="2">Accessibility</th><th colspan="3">Usable tasks</th><th rowspan="2">Description example</th></tr>
<tr><th>Read</th><th>Write</th><th>Normal</th><th>Event</th><th>NMI</th></tr>
<tr><td rowspan="2">Input</td><td>Input module non-loaded range</td><td>X</td><td>○</td><td>○</td><td rowspan="9">○</td><td rowspan="9">○</td><td rowspan="9">○</td><td>X100</td></tr>
<tr><td>Input module loaded range</td><td>PX</td><td>○</td><td>×</td><td>PX180</td></tr>
<tr><td rowspan="2">Output</td><td>Output module non-loaded range</td><td>Y</td><td>○</td><td>○</td><td>Y100</td></tr>
<tr><td>Output module loaded range</td><td>PY</td><td>○</td><td>○</td><td>PY1E0</td></tr>
<tr><td colspan="2">Internal relay</td><td>M</td><td>○</td><td>○</td><td>M20</td></tr>
<tr><td colspan="2">Latch relay</td><td>L</td><td>○</td><td>○</td><td>L1000</td></tr>
<tr><td colspan="2">Link relay</td><td>B</td><td>○</td><td>○</td><td>B3FF</td></tr>
<tr><td colspan="2">Annunciator</td><td>F</td><td>○</td><td>○</td><td>F0</td></tr>
<tr><td colspan="2">Special relay</td><td>M</td><td>○</td><td>○</td><td>M9000</td></tr>
</table>
○: usable
×: unusable

CAUTION
<Restrictions on write-enabled bit devices>
1) Write to device X is allowed only within the input module non-installed range.
2) Special relay has predetermined applications in the system.
Do not perform write to other than the user setting device.
(Note) : SET/RST is disabled in the following device ranges.
<table>
<tr><th>SET/RST disable range</th><th>Remark</th></tr>
<tr><td>M2001 to M2032</td><td>Start accept device</td></tr>
</table>
(Note) : DOUT output disabled in the following device ranges.
<table>
<tr><th>DOUT output disable range</th><th>Remark</th></tr>
<tr><td>Designation including M2000 to M2127</td><td>Dedicated device</td></tr>
<tr><td>M9000 to M9255</td><td>Special relay</td></tr>
</table>
</td><td>The input X/output Y are written with the actual input PX/actual output PY.
It does the layput of the I/O numbers of PX, PY by a set up of as system.
(In the operation control program/transition program, automatically represented as PX/PY according to the system setting information.)</td></tr>
</table>

Table of the operation control/transition control specification(continued)

<table>
<tr><th>Item</th><th colspan="4">Specifications</th><th>Remark</th></tr>
<tr><td>Word devices</td><td colspan="4">
<table>
<tr><th rowspan="2">Devices</th><th rowspan="2">Symbol</th><th colspan="2">Accessibility</th><th colspan="3">Usable tasks</th><th rowspan="2">Description example</th></tr>
<tr><th>Read</th><th>Write</th><th>Normal</th><th>Event</th><th>NMI</th></tr>
<tr><td>Data register</td><td>D</td><td>○</td><td>○</td><td rowspan="5">○</td><td rowspan="5">○</td><td rowspan="5">○</td><td>DOL</td></tr>
<tr><td>Link register</td><td>W</td><td>○</td><td>○</td><td>W1F : F</td></tr>
<tr><td>Special register</td><td>D</td><td>○</td><td>○</td><td>D9000</td></tr>
<tr><td>Motion register</td><td>#</td><td>○</td><td>○</td><td>#0F</td></tr>
<tr><td>Coasting timer</td><td>FT</td><td>○</td><td>×</td><td>FT</td></tr>
</table>
○: usable
×: unusable
CAUTION
<Restrictions on write-enabled word devices>
1) Special register has predetermined applications in the system.
Do not perform write to other than the user-set device.
</td><td></td></tr>
<tr><td rowspan="5">Data type</td><td rowspan="2">(None)</td><td colspan="2">16-bit integer type (signed)</td><td>-32768 to 32767</td><td rowspan="2">K10, D100, etc.</td></tr>
<tr><td colspan="2">16-bit integer type (unsigned)</td><td>0 to 65535</td></tr>
<tr><td rowspan="2">L</td><td colspan="2">32-bit integer type (signed)</td><td>-2147483648 to 2147483647</td><td rowspan="2">2000000000, W100L, etc.</td></tr>
<tr><td colspan="2">32-bit integer type (unsigned)</td><td>0 to 4294967295</td></tr>
<tr><td>F</td><td colspan="2">64-bit floating-point type (double precision real number type)</td><td>IEEE format</td><td>1.23, #10F, etc.</td></tr>
<tr><td rowspan="2">Constant</td><td>K</td><td>Decimal constant</td><td colspan="2" rowspan="2">The above data type symbol 'L' or '. (decimal point)' provided at the end indicates the data type. The constant without the data type is regarded as the applicable minimum type.</td><td rowspan="2">K-100, H0FFL, etc.
'K' may be omitted.</td></tr>
<tr><td>H</td><td>Hexadecimal constant</td></tr>
<tr><td rowspan="11">Number of instructions</td><td colspan="2">Binary operation</td><td>6</td><td rowspan="11">63 in total</td><td rowspan="11"></td></tr>
<tr><td colspan="2">Bit operation</td><td>6</td></tr>
<tr><td colspan="2">Sign</td><td>1</td></tr>
<tr><td colspan="2">Standard function</td><td>15</td></tr>
<tr><td colspan="2">Type conversion</td><td>6</td></tr>
<tr><td colspan="2">Bit device status</td><td>2</td></tr>
<tr><td colspan="2">Bit device control</td><td>5</td></tr>
<tr><td colspan="2">Logical operation</td><td>4</td></tr>
<tr><td colspan="2">Comparison operation</td><td>6</td></tr>
<tr><td colspan="2">Motion dedicated function</td><td>2</td></tr>
<tr><td colspan="2">Others</td><td>10</td></tr>
<tr><td rowspan="2">Read/write response of input PX, output PY</td><td colspan="2">Input response</td><td colspan="2">Direct read control at instruction execution.</td><td rowspan="2"></td></tr>
<tr><td colspan="2">Output response</td><td colspan="2">Direct write control at instruction execution.</td></tr>
</table>

(2) Table of the operation control/transition instruction

Classification	Symbol	Function	Format	Basic steps	Usable step		Y/N transition's conditional expression	Section of reference
					F/FS	G		
Binary operation	=	Substitution	(D)=(S)	4	○	○	—	7.4.1
	+	Addition	(S1)+(S2)	4	○	○	—	7.4.2
	-	Subtraction	(S1)-(S2)	4	○	○	—	7.4.3
	*	Multiplication	(S1)*(S2)	4	○	○	—	7.4.4
	/	Division	(S1)/(S2)	4	○	○	—	7.4.5
	%	Remainder	(S1)%(S2)	4	○	○	—	7.4.6
Bit operation	~	Bit inversion (complement)	~(S)	2	○	○	—	7.5.1
	&	Bit logical AND	(S1)&(S2)	4	○	○	—	7.5.2
	|	Bit logical OR	(S1)|(S2)	4	○	○	—	7.5.3
	^	Bit exclusive OR	(S1)^(S2)	4	○	○	—	7.5.4
	>>	Bit right shift	(S1)>>(S2)	4	○	○	—	7.5.5
	<<	Bit left shift	(S1)<<(S2)	4	○	○	—	7.5.6
Sign	-	Sign inversion (complement of 2)	-(S)	2	○	○	—	7.5.7
Standard function	SIN	Sine	SIN(S)	2	○	○	—	7.6.1
	COS	Cosine	COS(S)	2	○	○	—	7.6.2
	TAN	Tangent	TAN(S)	2	○	○	—	7.6.3
	ASIN	Arcsine	ASIN(S)	2	○	○	—	7.6.4
	ACOS	Arccosine	ACOS(S)	2	○	○	—	7.6.5
	ATAN	Arctangent	ATAN(S)	2	○	○	—	7.6.6
	SQRT	Square root	SQRT(S)	2	○	○	—	7.6.7
	LN	Natural logarithm	LN(S)	2	○	○	—	7.6.8
	EXP	Exponential operation	EXP(S)	2	○	○	—	7.6.9
	ABS	Absolute value	ABS(S)	2	○	○	—	7.6.10
	RND	Round-off	RND(S)	2	○	○	—	7.6.11
	FIX	Round-down	FIX(S)	2	○	○	—	7.6.12
	FUP	Round-up	FUP(S)	2	○	○	—	7.6.13
	BIN	BCD ⟶ BIN conversion	BIN(S)	2	○	○	—	7.6.14
	BCD	BIN ⟶ BCD conversion	BCD(S)	2	○	○	—	7.6.15
Type conversion	SHORT	Convert into 16-bit integer type (signed)	SHORT(S)	2	○	○	—	7.7.1
	USHORT	Convert into 16-bit integer type (unsigned)	USHORT(S)	2	○	○	—	7.7.2
	LONG	Convert into 32-bit integer type (signed)	LONG(S)	2	○	○	—	7.7.3
	ULONG	Convert into 32-bit integer type (unsigned)	ULONG(S)	2	○	○	—	7.7.4
	FLOAT	Regard as signed data and convert into 64-bit floating point type	FLOAT(S)	2	○	○	—	7.7.5
	UFLOAT	Regard as unsigned data and convert into 64-bit floating point type	UFLOAT(S)	2	○	○	—	7.7.6
Bit device status	(None)	ON (normally open contact)	(S)	2	○	○	○	7.8.1
	!	OFF (normally closed contact)	!(S)	2	○	○	○	7.8.2
Bit device control	SET	Device set	SET(D)	3	○	○	—	7.9.1
			SET(D)= (conditional expression)	4	○	○	—	
	RST	Device reset	RST(D)	3	○	○	—	7.9.2
			RST(D)=(conditional expression)	4	○	○	—	
	DOUT	Device output	DOUT(D),(S)	4	○	○	—	7.9.3
	DIN	Device input	DIN(D),(S)	4	○	○	—	7.9.4
	OUT	Bit device output	OUT(D)=(conditional expression)	4	○	○	—	7.9.5

Table of the operation control/transition instruction (continued)

Classification	Symbol	Function	Format	Basic steps	Usable step		Y/N transition's conditional expression	Section of reference
					F/FS	G		
Logical operation	(None)	Logical acknowledgment	(Conditional expression)	0	○	○	○	7.10.1
	!	Logical negation	!(Conditional expression)	2	○	○	○	7.10.2
	*	Logical AND	(Conditional expression) * (conditional expression)	4	○	○	○	7.10.3
	+	Logical OR	(Conditional expression) + (conditional expression)	4	○	○	○	7.10.4
Comparison operation	==	Equal to	(Conditional expression) == (conditional expression)	4	○	○	○	7.11.1
	!=	Not equal to	(Conditional expression) != (conditional expression)	4	○	○	○	7.11.2
	<	Less than	(Conditional expression) < (conditional expression)	4	○	○	○	7.11.3
	<=	Less than or equal to	(Conditional expression) <= (conditional expression)	4	○	○	○	7.11.4
	>	More than	(Conditional expression) > (conditional expression)	4	○	○	○	7.11.5
	>=	More than or equal to	(Conditional expression) >= (conditional expression)	4	○	○	○	7.11.6
Motion dedicated function	CHGV	Speed change request	CHGV((S1),(S2))	4	○	○	—	7.12.1
	CHGT	Torque limit value change request	CHGT((S1),(S2))	4	○	○	—	7.12.2
Others	EI	Event task enable	EI	1	○	○	—	7.13.1
	DI	Event task disable	DI	1	○	○	—	7.13.2
	NOP	No operation	NOP	1	○	○	—	7.13.3
	BMOV	Block transfer	BMOV(D),(S),(n)	6	○	○	—	7.13.4
	FMOV	Same data block transfer	FMOV(D),(S),(n)	6	○	○	—	7.13.5
	MULTW	Write device data to shared CPU memory of the self CPU	MULTW(D),(S),(n),(D1)	8	○	○	—	7.13.6
	MULTR	Read device data from shared CPU memory of the other CPU	MULTR(D),(S1),(S2),(n)	7	○	○	—	7.13.7
	TO	Write device data to intelligent function module/special function module.	TO(D1),(D2),(S),(n)	7	○	○	—	7.13.8
	FROM	Read device data from intelligent function module/special function module.	FROM(D),(S1),(S2),(n)	7	○	○	—	7.13.9
	TIME	Time to wait	TIME(S)	7	—	○	—	7.13.10

○: Usable —: Unusable

(3) Rough calculation expression of singleprogram for operation control/transition program

2 + (1 + Total number of basic steps in 1 block
+ Number of 32-bit constants/1 block × 1
+ Number of 64-bit constants/1 block × 3) × Number of blocks (steps)
(1 step = 2 bytes)

1.2.4 Differences between Q173CPU(N)/Q172CPU(N) and A173UHCPU/A172SHCPUN

(1) Differences between Q173CPU(N)/Q172CPU(N) and A173UHCPU/A172SHCPUN

Item					Q173CPU(N)	Q172CPU(N)	A173UHCPU	A172SHCPUN
Motion control	Number of control axes				Up to 32 axes	Up to 8 axes	Up to 32 axes	Up to 8 axes
	Operation cycle	SV13			0.88ms/1 to 8 axes 1.77ms/9 to 16 axes 3.55ms/17 to 32 axes (Default) (It can be set up by the parameters.)	0.88ms/1 to 8 axes (Default) (It can be set up by the parameters.)	3.55ms/1 to 20 axes 7.11ms/21 to 32 axes	3.55ms/1 to 8 axes
		SV22			0.88ms/1 to 4 axes 1.77ms/5 to 12 axes 3.55ms/13 to 24 axes 7.11ms/25 to 32 axes (Default) (It can be set up by the parameters.)	0.88ms/1 to 4 axes 1.77ms/5 to 8 axes (Default) (It can be set up by the parameters.)	3.55ms/1 to 12 axes 7.11ms/13 to 24 axes 14.2ms/25 to 32 axes	3.55 ms/1 to 8 axes
	Servo program capacity				14k steps			13k steps
	Number of positioning points				3200 points/axis (Positioning data can be designated indirectly.)			
	Programming tool				IBM PC/AT, A31TU-D		PC9800 series, IBM PC/AT, A30TU, A31TU	
	Peripheral devices I/F				USB/RS-232/SSCNET		RS-422/SSCNET	
	Home position return function				Proximity dog type(2 types), Count type(3 types), Data set type(2 types), Dog cradle type, Stopper type(2 types), Limit switch conbined type (Home position return retry function provided, Home position shift function provided)		Proximity dog type, count type, data set type 1	
	Manual pulse generator operation function				Possible to connect 3 modules			Possible to connect 1 module
	Syncronous encoder operation function				Possible to connect 12 modules	Possible to connect 8 modules	Possible to connect 4 modules	
	Limit switch output function				Output points : 32points, watch data : motion control data/word device			
	Number of SSCNET Interfaces (Included SSCNET interface 1CH to the parsonal computer)				5CH (Note-1)	2CH	4CH	2CH
	Number of motion slots				Up to 64 slots (Up to 7 extension bases of the Q series)		8 slots	2 slots
	Number of Motion related modules				Q172LX : 4 modules Q172EX : 6 modules Q173PX : 4 modules (Note-2)	Q172LX : 1 module Q172EX : 4 modules Q173PX : 3 modules (Note-2)	A172SENC : 4 modules	A172SENC : 1 module
Motion SFC	Execute specification	Normal task			Executed in motion main cycle			
		Excuted task	Event task (Execution can be masked.)	Fixed cycle	Executed in fixed cycle (0.88ms, 1.77ms, 3.55ms, 7.11ms, 14.2ms)		Executed in fixed cycle (1.77ms, 3.55ms, 7.11ms, 14.2ms)	
				External interrupt	Executed when input on is set among interrupt module(QI60) 16 points.		Executed when input on is set among interrupt module(A1SI61) 16 points.	
				PLC interrupt	Executed with interrupt instruction (GINT) from PLC CPU.		Executed when 1 interrupt point is provided from PLC CPU.	
			NMI task		Executed when input on is set among interrupt module(QI60) 16 points.		Executed when input on is set among interrupt module(A1SI61) 16 points.	
	Number of I/O (X/Y) points				8192 points			2048 points
	Number of real I/O (PX/PY) points				Total 256 points			

Differences Between Q173CPU(N)/Q172CPU(N) and A173UHCPU/A172SHCPUN(continued)

Item			Q173CPU(N)	Q172CPU(N)	A173UHCPU	A172SHCPUN
Motion SFC	Number of Devices (internal motion CPU only)	Internal relays (M)	Total M+L : 8192 points		Total M+L(S) : 8192 points	Total M+L(S) : 2048 points
		Latch relays (L)				
		Link relays (B)	8192 points			1024 points
		Annunciators (F)	2048 points			256 points
		Timer contacts (TT)	—		2048 points	256 points
		Timer coils (TC)	—		2048 points	256 points
		Counter contacts (CT)	—		1024 points	256 points
		Counter coils (CC)	—		1024 points	256 points
		Special relays (M)	256 points			
		Data registers (D)	8192 points			1024 points
		Link registers (W)	8192 points			1024 points
		Currnet value timers (T)	—		2048 points	256 points
		Currnet value counters (C)	—		1024 points	256 points
		Special registers (D)	256 points			
		Motion registers (#)	8192 points			
		Coasting timer (FT)	1 point (888μs)			
Others	Device memory		Independence		Commonness	
	Data exchange of PCPU and SCPU		The data exchange method by automatic refresh between the multiple CPU's.		The direct data exchange method which made a device memory 2 port memory.	
	Fixed parameters	Number of pulses per revolutions	1 to 2147483647[PLS]		1 to 65535[PLS]	
		Amount of pulses per revolutions	In the case of the unit setup [PLS]. 1 to 2147483647[PLS]		In the case of the unit setup [PLS]. 1 to 65535[PLS]	
		Magnification	—		×1 time, ×10 times, ×100 times, ×1000 times	
	PLC ready flag (M2000)		M2000 turn it on with switch (STOP → RUN), or M2000 turn it on when both of switch RUN and setting register is set "1".		M2000 turn on by PLC program	
	Forced stop input		An optional bit device(PX, M) is specified in the parameter. (Emergency stop terminals of the servo amplifiers can be used.)		Emergency stop of the CPU base unit. (Forced stop terminals of the servo amplifiers cannot be used.)	
	Back-up battery for internal memory		Internal rechargeable battery (Set the external battery (A6BAT/MR-BAT) if continuous power off time is longer for 1 month or more.) (Note-3)		A6BAT/MR-BAT	

(Note-1) : Use the Dividing unit (Q173DV) or dividing cable (Q173J2B△CBL□M/Q173HB△CBL□M).

(Note-2) : When using the incremental synchronous encoder (SV22 use), you can use above number of modules. When connecting the Manual pulse generator, you can use only 1 module.

(Note-3) : When adding the external battery (A6BAT/MR-BAT), Q173DV (Q173CPU(N) use.), or Q170BAT (Q172CPU(N) use.) is used.

1.2.5 Positioning dedicated devices/special relays/special registers

(1) Positioning dedicated devices

The following section describes the positioning dedicated devices.

A range of up to 32 axes is valid in Q173CPU(N), and a range of up to 8 axes is valid in Q172CPU(N).
Refer to the "Q173CPU(N)/Q172CPU(N) Motion controller (SV13/SV22) Programming Manual (REAL MODE)", "Q173CPU(N)/Q172CPU(N) Motion controller (SV22) Programming Manual (VIRTUAL MODE)" for details of the positioning dedicated devices.

(a) Table of the internal relays

- Overall configuration

SV13		SV22	
Device No.	Purpose	Device No.	Purpose
M0 to	User device (2000 points)	M0 to	User device (2000 points)
M2000 to	Common device (320 points)	M2000 to	Common device (320 points)
M2320 to	Special relay allocated device (Status) (80 points)	M2320 to	Special relay allocated device (Status) (80 points)
M2400 to	Axis status (20 points × 32 axes)	M2400 to	Axis status (20 points × 32 axes) Real mode……Each axis Virtual mode….Output module
M3040 to	Unusable	M3040 to	Unusable
M3072 to	Common device (Command signal) (64 points)	M3072 to	Common device (Command signal) (64 points)
M3136 to	Special relay allocated device (Command signal) (64 points)	M3136 to	Special relay allocated device (Command signal) (64 points)
M3200 to	Axis command signal (20 points × 32 axes)	M3200 to	Axis command signal (20 points × 32 axes) Real mode……Each axis Virtual mode….Output module
M3840 to M4799	User device (960 points)	M3840 to	Unusable (Note-1) (160 points)
		M4000 to	Virtual servomotor axis status (Note-1,2) (20 points × 32 axes) (Mechanical system setting axis only)
		M4640 to	Synchronous encoder axis status (Note-2) (4 points × 12 axes)
		M4688 to M4799	Unusable (Note-1)

- Overall configuration(Continued)

SV13		SV22	
Device No.	Purpose	Device No.	Purpose
M4800 to M8191	User device (3392 points)	M4800 to	Virtual servomotor axis command signal (Note-1, 2) (20 points × 32 axes) (Mechanical system setting axis only)
		M5440 to	Synchronous encoder axis command signal (Note-2) (4 points × 12 axes)
		M5488 to	Cam axis command signal (Note-1, 2) (1 point × 32 axes) (Mechanical system setting axis only)
		M5520 to	Smoothing clutch complete signal (Note-1, 2) (2 points × 32 axes)
		M5584 to	Unusable (Note-1) (16 points)
		M5600 to M8191	User device (2592 points)

(Note-1) : It can be used as an user device in the SV22 real mode only.

(Note-2) : Do not set the M4000 to M5599 as a latch range in the virtual mode.

MEMO

1) Table of the axis statuses (SV13/SV22)

Device No.	Signal name	Device No.	Signal name
M2400 to M2419	Axis 1 status	M2720 to M2739	Axis 17 status
M2420 to M2439	Axis 2 status	M2740 to M2759	Axis 18 status
M2440 to M2459	Axis 3 status	M2760 to M2779	Axis 19 status
M2460 to M2479	Axis 4 status	M2780 to M2799	Axis 20 status
M2480 to M2499	Axis 5 status	M2800 to M2819	Axis 21 status
M2500 to M2519	Axis 6 status	M2820 to M2839	Axis 22 status
M2520 to M2539	Axis 7 status	M2840 to M2859	Axis 23 status
M2540 to M2559	Axis 8 status	M2860 to M2879	Axis 24 status
M2560 to M2579	Axis 9 status	M2880 to M2899	Axis 25 status
M2580 to M2599	Axis 10 status	M2900 to M2919	Axis 26 status
M2600 to M2619	Axis 11 status	M2920 to M2939	Axis 27 status
M2620 to M2639	Axis 12 status	M2940 to M2959	Axis 28 status
M2640 to M2659	Axis 13 status	M2960 to M2979	Axis 29 status
M2660 to M2679	Axis 14 status	M2980 to M2999	Axis 30 status
M2680 to M2699	Axis 15 status	M3000 to M3019	Axis 31 status
M2700 to M2719	Axis 16 status	M3020 to M3039	Axis 32 status

- Detailes of each axis

Device No.	Signal name	
M2400 + 20n	Positioning start complete	
M2401 + 20n	Positioning complete	
M2402 + 20n	In-position	
M2403 + 20n	Command in-position	
M2404 + 20n	Speed controlling	
M2405 + 20n	Speed/position switching latch signal	
M2406 + 20n	Zero pass signal	
M2407 + 20n	Error detection signal	
M2408 + 20n	Servo error detection signal	
M2409 + 20n	Home position return request signal	
M2410 + 20n	Home position return completion signal	
M2411 + 20n	External signals	FLS signal
M2412 + 20n		RLS signal
M2413 + 20n		STOP signal
M2414 + 20n		DOG/CHANGE signal
M2415 + 20n	Servo ready signal	
M2416 + 20n	Torque limiting signal	
M2417 + 20n	Unusable	
M2418 + 20n	Virtual mode continuation operation disable warning signal (SV22)	
M2419 + 20n	M-code outputting signal	

(Note-1) : "n" in the above device No. shows the numerical value which correspond to axis No.
Q173CPU(N) : Axis No.1 to No.32 (n=0 to 31)
Q172CPU(N) : Axis No.1 to No.8 (n=0 to 7)

(Note-2) : Device area of 9 axes or more is unusable in the Q172CPU(N).

2) Table of the axis command signals (SV13/SV22)

Device No.	Signal name	Device No.	Signal name
M3200 to M3219	Axis 1 command signal	M3520 to M3539	Axis 17 command signal
M3220 to M3239	Axis 2 command signal	M3540 to M3559	Axis 18 command signal
M3240 to M3259	Axis 3 command signal	M3560 to M3579	Axis 19 command signal
M3260 to M3279	Axis 4 command signal	M3580 to M3599	Axis 20 command signal
M3280 to M3299	Axis 5 command signal	M3600 to M3619	Axis 21 command signal
M3300 to M3319	Axis 6 command signal	M3620 to M3639	Axis 22 command signal
M3320 to M3339	Axis 7 command signal	M3640 to M3659	Axis 23 command signal
M3340 to M3359	Axis 8 command signal	M3660 to M3679	Axis 24 command signal
M3360 to M3379	Axis 9 command signal	M3680 to M3699	Axis 25 command signal
M3380 to M3399	Axis 10 command signal	M3700 to M3719	Axis 26 command signal
M3400 to M3419	Axis 11 command signal	M3720 to M3739	Axis 27 command signal
M3420 to M3439	Axis 12 command signal	M3740 to M3759	Axis 28 command signal
M3440 to M3459	Axis 13 command signal	M3760 to M3779	Axis 29 command signal
M3460 to M3479	Axis 14 command signal	M3780 to M3799	Axis 30 command signal
M3480 to M3499	Axis 15 command signal	M3800 to M3819	Axis 31 command signal
M3500 to M3519	Axis 16 command signal	M3820 to M3839	Axis 32 command signal

- Detailes of each axis

Device No.	SV13	SV22
M3200 + 20n	Stop command	Stop command
M3201 + 20n	Rapid stop command	Rapid stop command
M3202 + 20n	Forward rotation JOG start command	Forward rotation JOG start command
M3203 + 20n	Reverse rotation JOG start command	Reverse rotation JOG start comannd
M3204 + 20n	Complete signal OFF command	Complete signal OFF command
M3205 + 20n	Speed/position switching enable command	Speed/position switching enable comannd
M3206 + 20n	Unusable	Unusable
M3207 + 20n	Error reset command	Error reset command
M3208 + 20n	Servo error reset command	Servo error reset command
M3209 + 20n	External stop input disable at start command	External stop input disable at start command
M3210 + 20n	Unusable	Unusable
M3211 + 20n		
M3212 + 20n	Feed current value update request command	Feed current value update request command
M3213 + 20n	Unusable	Address clutch reference setting command
M3214 + 20n		Cam reference position setting command
M3215 + 20n	Servo OFF command	Servo OFF command
M3216 + 20n	Gain changing command	Gain changing command
M3217 + 20n	Unusable	Unusable
M3218 + 20n		
M3219 + 20n	FIN signal	FIN signal

(Note-1) : "n" in the above device No. shows the numerical value which correspond to axis No.
Q173CPU(N) : Axis No.1 to No.32 (n=0 to 31)
Q172CPU(N) : Axis No.1 to No.8 (n=0 to 7)

(Note-2) : Device area of 9 axes or more is unusable in the Q172CPU(N).

3) Table of the virtual servomotor axis statuses (SV22 only)

Device No.	Signal name	Device No.	Signal name
M4000 to M4019	Axis 1 status	M4320 to M4339	Axis 17 status
M4020 to M4039	Axis 2 status	M4340 to M4359	Axis 18 status
M4040 to M4059	Axis 3 status	M4360 to M4379	Axis 19 status
M4060 to M4079	Axis 4 status	M4380 to M4399	Axis 20 status
M4080 to M4099	Axis 5 status	M4400 to M4419	Axis 21 status
M4100 to M4119	Axis 6 status	M4420 to M4439	Axis 22 status
M4120 to M4139	Axis 7 status	M4440 to M4459	Axis 23 status
M4140 to M4159	Axis 8 status	M4460 to M4479	Axis 24 status
M4160 to M4179	Axis 9 status	M4480 to M4499	Axis 25 status
M4180 to M4199	Axis 10 status	M4500 to M4519	Axis 26 status
M4200 to M4219	Axis 11 status	M4520 to M4539	Axis 27 status
M4220 to M4239	Axis 12 status	M4540 to M4559	Axis 28 status
M4240 to M4259	Axis 13 status	M4560 to M4579	Axis 29 status
M4260 to M4279	Axis 14 status	M4580 to M4599	Axis 30 status
M4280 to M4299	Axis 15 status	M4600 to M4619	Axis 31 status
M4300 to M4319	Axis 16 status	M4620 to M4639	Axis 32 status

- Detailes of each axis

Device No.	Signal name
M4000 + 20n	Positioning start complete
M4001 + 20n	Positioning complete
M4002 + 20n	Unusable
M4003 + 20n	Command in-position
M4004 + 20n	Speed controlling
M4005 + 20n	Unusable
M4006 + 20n	
M4007 + 20n	Error detection
M4008 + 20n	Unusable
M4009 + 20n	
M4010 + 20n	
M4011 + 20n	
M4012 + 20n	
M4013 + 20n	
M4014 + 20n	
M4015 + 20n	
M4016 + 20n	
M4017 + 20n	
M4018 + 20n	
M4019 + 20n	M-code outputting signal

(Note-1) : "n" in the above device No. shows the numerical value which correspond to axis No.
Q173CPU(N) : Axis No.1 to No.32 (n=0 to 31)
Q172CPU(N) : Axis No.1 to No.8 (n=0 to 7)

(Note-2) : The unused axis areas in the mechanical system program can be used as an user device.

4) Table of the virtual servomotor axis command signals (SV22 only)

Device No.	Signal name	Device No.	Signal name
M4800 to M4819	Axis 1 command signal	M5120 to M5139	Axis 17 command signal
M4820 to M4839	Axis 2 command signal	M5140 to M5159	Axis 18 command signal
M4840 to M4859	Axis 3 command signal	M5160 to M5179	Axis 19 command signal
M4860 to M4879	Axis 4 command signal	M5180 to M5199	Axis 20 command signal
M4880 to M4899	Axis 5 command signal	M5200 to M5219	Axis 21 command signal
M4900 to M4919	Axis 6 command signal	M5220 to M5239	Axis 22 command signal
M4920 to M4939	Axis 7 command signal	M5240 to M5259	Axis 23 command signal
M4940 to M4959	Axis 8 command signal	M5260 to M5279	Axis 24 command signal
M4960 to M4979	Axis 9 command signal	M5280 to M5299	Axis 25 command signal
M4980 to M4999	Axis 10 command signal	M5300 to M5319	Axis 26 command signal
M5000 to M5019	Axis 11 command signal	M5320 to M5339	Axis 27 command signal
M5020 to M5039	Axis 12 command signal	M5340 to M5359	Axis 28 command signal
M5040 to M5059	Axis 13 command signal	M5360 to M5379	Axis 29 command signal
M5060 to M5079	Axis 14 command signal	M5380 to M5399	Axis 30 command signal
M5080 to M5099	Axis 15 command signal	M5400 to M5419	Axis 31 command signal
M5100 to M5119	Axis 16 command signal	M5420 to M5439	Axis 32 command signal

- Detailes of each axis

Device No.	Signal name
M4800 + 20n	Stop command
M4801 + 20n	Rapid stop command
M4802 + 20n	Forward rotation JOG start command
M4803 + 20n	Reverse rotation JOG start command
M4804 + 20n	Complete signal OFF command
M4805 + 20n	Unusable
M4806 + 20n	
M4807 + 20n	Error reset command
M4808 + 20n	Unusable
M4809 + 20n	External stop input disable at start command
M4810 + 20n	Unusable
M4811 + 20n	
M4812 + 20n	
M4813 + 20n	
M4814 + 20n	
M4815 + 20n	
M4816 + 20n	
M4817 + 20n	
M4818 + 20n	
M4819 + 20n	FIN signal

(Note-1) : "n" in the above device No. shows the numerical value which correspond to axis No.
Q173CPU(N) : Axis No.1 to No.32 (n=0 to 31)
Q172CPU(N) : Axis No.1 to No.8 (n=0 to 7)

(Note-2) : The unused axis areas in the mechanical system program can be used as an user device.

5) Table of the synchronous encoder axis statuses (SV22 only)

Device No.	Signal name	
M4640	Axis 1	Error detection
M4641		External signal TREN
M4642		Virtual mode continuation operation disable warning
M4643		Unusable
M4644	Axis 2	Error detection
M4645		External signal TREN
M4646		Virtual mode continuation operation disable warning
M4647		Unusable
M4648	Axis 3	Error detection
M4649		External signal TREN
M4650		Virtual mode continuation operation disable warning
M4651		Unusable
M4652	Axis 4	Error detection
M4653		External signal TREN
M4654		Virtual mode continuation operation disable warning
M4655		Unusable
M4656	Axis 5	Error detection
M4657		External signal TREN
M4658		Virtual mode continuation operation disable warning
M4659		Unusable
M4660	Axis 6	Error detection
M4661		External signal TREN
M4662		Virtual mode continuation operation disable warning
M4663		Unusable
M4664	Axis 7	Error detection
M4665		External signal TREN
M4666		Virtual mode continuation operation disable warning
M4667		Unusable
M4668	Axis 8	Error detection
M4669		External signal TREN
M4670		Virtual mode continuation operation disable warning
M4671		Unusable
M4672	Axis 9	Error detection
M4673		External signal TREN
M4674		Virtual mode continuation operation disable warning
M4675		Unusable
M4676	Axis 10	Error detection
M4677		External signal TREN
M4678		Virtual mode continuation operation disable warning
M4679		Unusable
M4680	Axis 11	Error detection
M4681		External signal TREN
M4682		Virtual mode continuation operation disable warning
M4683		Unusable
M4684	Axis 12	Error detection
M4685		External signal TREN
M4686		Virtual mode continuation operation disable warning
M4687		Unusable

(Note-1) : The range of axis No.1 to 8 is valid in the Q172CPU(N).

(Note-2) : Device area of 9 axes or more is unusable in the Q172CPU(N).

6) Table of the syncronous encoder axis command signals (SV22 only)

Device No.	Signal name	
M5440	Axis 1	Error reset
M5441		Unusable
M5442		Unusable
M5443		Unusable
M5444	Axis 2	Error reset
M5445		Unusable
M5446		Unusable
M5447		Unusable
M5448	Axis 3	Error reset
M5449		Unusable
M5450		Unusable
M5451		Unusable
M5452	Axis 4	Error reset
M5453		Unusable
M5454		Unusable
M5455		Unusable
M5456	Axis 5	Error reset
M5457		Unusable
M5458		Unusable
M5459		Unusable
M5460	Axis 6	Error reset
M5461		Unusable
M5462		Unusable
M5463		Unusable
M5464	Axis 7	Error reset
M5465		Unusable
M5466		Unusable
M5467		Unusable
M5468	Axis 8	Error reset
M5469		Unusable
M5470		Unusable
M5471		Unusable
M5472	Axis 9	Error reset
M5473		Unusable
M5474		Unusable
M5475		Unusable
M5476	Axis 10	Error reset
M5477		Unusable
M5478		Unusable
M5479		Unusable
M5480	Axis 11	Error reset
M5481		Unusable
M5482		Unusable
M5483		Unusable
M5484	Axis 12	Error reset
M5485		Unusable
M5486		Unusable
M5487		Unusable

(Note-1) : The range of axis No.1 to 8 is valid in the Q172CPU(N).

(Note-2) : Device area of 9 axes or more is unusable in the Q172CPU(N).

7) Table of the cam axis command signals (SV22 only)

Device No.	Signal name
M5488	Axis 1 cam/ballscrew switching
M5489	Axis 2 cam/ballscrew switching
M5490	Axis 3 cam/ballscrew switching
M5491	Axis 4 cam/ballscrew switching
M5492	Axis 5 cam/ballscrew switching
M5493	Axis 6 cam/ballscrew switching
M5494	Axis 7 cam/ballscrew switching
M5495	Axis 8 cam/ballscrew switching
M5496	Axis 9 cam/ballscrew switching
M5497	Axis 10 cam/ballscrew switching
M5498	Axis 11 cam/ballscrew switching
M5499	Axis 12 cam/ballscrew switching
M5500	Axis 13 cam/ballscrew switching
M5501	Axis 14 cam/ballscrew switching
M5502	Axis 15 cam/ballscrew switching
M5503	Axis 16 cam/ballscrew switching
M5504	Axis 17 cam/ballscrew switching
M5505	Axis 18 cam/ballscrew switching
M5506	Axis 19 cam/ballscrew switching
M5507	Axis 20 cam/ballscrew switching
M5508	Axis 21 cam/ballscrew switching
M5509	Axis 22 cam/ballscrew switching
M5510	Axis 23 cam/ballscrew switching
M5511	Axis 24 cam/ballscrew switching
M5512	Axis 25 cam/ballscrew switching
M5513	Axis 26 cam/ballscrew switching
M5514	Axis 27 cam/ballscrew switching
M5515	Axis 28 cam/ballscrew switching
M5516	Axis 29 cam/ballscrew switching
M5517	Axis 30 cam/ballscrew switching
M5518	Axis 31 cam/ballscrew switching
M5519	Axis 32 cam/ballscrew changing

(Note-1) : The range of axis No.1 to 8 is valid in the Q172CPU(N).

(Note-2) : Device area of 9 axes or more is unusable in the Q172CPU(N).

(Note-3) : The unused aixs areas in the cam axis command signal can be used as an user device.

8) Table of the smoothing clutch complete signals (SV22 only)

Device No.	Signal name		Refresh cycle	Fetch cycle	Signal direction	Remark
M5520	Output axis 1	Main shaft side	Operation cycle		Status signal	
M5521		Auxiliary input side				
M5522	Output axis 2	Main shaft side				
M5523		Auxiliary input side				
M5524	Output axis 3	Main shaft side				
M5525		Auxiliary input side				
M5526	Output axis 4	Main shaft side				
M5527		Auxiliary input side				
M5528	Output axis 5	Main shaft side				
M5529		Auxiliary input side				
M5530	Output axis 6	Main shaft side				
M5531		Auxiliary input side				
M5532	Output axis 7	Main shaft side				
M5533		Auxiliary input side				
M5534	Output axis 8	Main shaft side				
M5535		Auxiliary input side				
M5536	Output axis 9	Main shaft side				
M5537		Auxiliary input side				
M5538	Output axis 10	Main shaft side				
M5539		Auxiliary input side				
M5540	Output axis 11	Main shaft side				
M5541		Auxiliary input side				
M5542	Output axis 12	Main shaft side				
M5543		Auxiliary input side				
M5544	Output axis 13	Main shaft side				
M5545		Auxiliary input side				
M5546	Output axis 14	Main shaft side				
M5547		Auxiliary input side				
M5548	Output axis 15	Main shaft side				
M5549		Auxiliary input side				
M5550	Output axis 16	Main shaft side				
M5551		Auxiliary input side				
M5552	Output axis 17	Main shaft side				
M5553		Auxiliary input side				
M5554	Output axis 18	Main shaft side				
M5555		Auxiliary input side				
M5556	Output axis 19	Main shaft side				
M5557		Auxiliary input side				
M5558	Output axis 20	Main shaft side				
M5559		Auxiliary input side				
M5560	Output axis 21	Main shaft side				
M5561		Auxiliary input side				
M5562	Output axis 22	Main shaft side				
M5563		Auxiliary input side				
M5564	Output axis 23	Main shaft side				
M5565		Auxiliary input side				
M5566	Output axis 24	Main shaft side				
M5567		Auxiliary input side				
M5568	Output axis 25	Main shaft side				
M5569		Auxiliary input side				
M5570	Output axis 26	Main shaft side				
M5571		Auxiliary input side				
M5572	Output axis 27	Main shaft side				
M5573		Auxiliary input side				
M5574	Output axis 28	Main shaft side				
M5575		Auxiliary input side				
M5576	Output axis 29	Main shaft side				
M5577		Auxiliary input side				
M5578	Output axis 30	Main shaft side				
M5579		Auxiliary input side				
M5580	Output axis 31	Main shaft side				
M5581		Auxiliary input side				
M5582	Output axis 32	Main shaft side				
M5583		Auxiliary input side				

(Note-1) : The range of axis No.1 to 8 is valid in the Q172CPU(N).

(Note-2) : Device area of 9 axes or more is unusable in the Q172CPU(N).

(Note-3) : The unused aixs areas in the mechanical system program can be used as an user device.

9) Table of the common devices (SV13/SV22)

SV13			SV22			Refresh cycle	Fetch cycle	Signal direction	Remark (Note-4)
Device No.	Signal name		Device No.	Signal name					
M2000	PLC ready flag		M2000	PLC ready flag			Main cycle	Command signal (Note-1)	M3072
M2001	Axis1	Start accept flag (32 points)	M2001	Axis1	Start accept flag (32 points)	Operation cycle		Status signal (Note-2, 3)	
to	to		to	to					
M2032	Axis32		M2032	Axis32					
M2033	Unusable		M2033	Unusable		—	—	—	
M2034	Personal computer link communication error flag		M2034	Personal computer link communication error flag		Operation cycle		Status signal	
M2035	Motion SFC error history clear request flag (Note-5)		M2035	Motion SFC error history clear request flag (Note-5)			Main cycle	Command signal	M3080
M2036	Unusable		M2036	Unusable		—	—	—	
M2037			M2037						
M2038	Motion SFC debugging flag		M2038	Motion SFC debugging flag		At debug mode transition		Status signal	
M2039	Motion SFC error detection flag		M2039	Motion SFC error detection flag			Immedi-ate	Status signal	
M2040	Speed switching point specified flag		M2040	Speed switcing point specified flag			At start	Command signal (Note-1)	M3073
M2041	System setting error flag		M2041	System setting error flag		Operation cycle		Status signal	
M2042	All axes servo ON command		M2042	All axes servo ON command			Operation cycle	Command signal (Note-1)	M3074
M2043	Unusable		M2043	Real mode/virtual mode switching request			At virtual mode transition		M3075
M2044			M2044	Real mode/virtual mode switching status		At virtual mode transition		Status signal	
M2045			M2045	Real mode/virtual mode switching error detection flag					
M2046			M2046	Out-of-sync warning					
M2047	Motion slot fault detection flag		M2047	Motion slot fault detection flag		Operation cycle			
M2048	JOG operation simultaneous start command		M2048	JOG operation simultaneous start command			Main cycle	Command signal (Note-1)	M3076
M2049	All axes servo ON accept flag		M2049	All axes servo ON accept flag		Operation cycle		Status signal	
M2050	Unusable		M2050	Unusable		—	—	—	
M2051	Manual pulse generator 1 enable flag		M2051	Manual pulse generator 1 enable flag			Main cycle	Command signal (Note-1)	M3077
M2052	Manual pulse generator 2 enable flag		M2052	Manual pulse generator 2 enable flag					M3078
M2053	Manual pulse generator 3 enable flag		M2053	Manual pulse generator 3 enable flag					M3079

Table of the common devices (SV13/SV22) (continued)

SV13			SV22				Refresh cycle	Fetch cycle	Signal direction	Remark (Note-4)
Device No.	Signal name		Device No.	Signal name						
M2054	Operation cycle over flag		M2054	Operation cycle over flag			Operation cycle		Status signal	
M2055	Unusable		M2055	Unusable			—	—	—	
to			to							
M2060			M2060							
M2061	Axis 1	Speed changing flag (32 axes)	M2061	Axis 1	Speed changing flag (32 axes)		Operation cycle		Status signal (Note-2, 3)	
to	to		to	to						
M2092	Axis 32		M2092	Axis 32						
M2093	Unusable		M2093	Unusable			—	—	—	
			to							
			M2100							
			M2101	Axis 1	Synchronous encoder current value changing flag (12 axes)		Operation cycle		Status signal (Note-2, 3)	
to			to	to						
			M2112	Axis 12						
			M2113	Unusable			—	—	—	
			to							
M2127			M2127							
M2128	Axis 1	Automatic decelerating flag (32 axes)	M2128	Axis 1	Automatic decelerating flag (32 axes)		Operation cycle		Status signal (Note-2, 3)	
to	to		to	to						
M2159	Axis 32		M2159	Axis 32						
M2160	Unusable		M2160	Output axis 1	Main shaft side	Clutch status (Note-6)				
			M2161		Auxiliary input side					
to			to	to	to					
			M2222	Output axis 32	Main shaft side					
			M2223		Auxiliary input side					
			M2224	Unusable			—	—	—	
			to							
M2239			M2239							
M2240	Axis 1	Speed change "0" accepting flag (32 axes)	M2240	Axis 1	Speed change "0" accepting flag (32 axes)		Operation cycle		Status signal (Note-2, 3)	
to	to		to	to						
M2271	Axis 32		M2271	Axis 32						
M2272	Unusable		M2272	Unusable			—	—	—	
to			to							
M2319			M2319							

Explanation of the request register

No.	Function	Bit device	Request register
1	PLC ready flag	M2000	D704
2	Speed switching point specified flag	M2040	D705
3	All axes servo ON command	M2042	D706
4	Real mode/virtual mode switching request (SV22)	M2043	D707
5	JOG operation simultaneous start command	M2048	D708
6	Manual pulse generator 1 enable flag	M2051	D755
7	Manual pulse generator 2 enable flag	M2052	D756
8	Manual pulse generator 3 enable flag	M2053	D757

(Note-1) : Handling of D704 to D708 and D755 to D757 register
Because cannot be turn ON/OFF for every bit from the PLC CPU, the above bit devices are assigned to D register, and each bit device becomes on with the lowest rank bit 0 → 1 of each register, and each bit device becomes off with 1 → 0.
Use it when the above functions are requested from the PLC CPU using the S(P).DDRD and S(P).DDWR instruction. Refer to "5 MOTION DEDICATED PLC INSTRUCTION " for S(P).DDRD and S(P).DDWR instruction.

(Note-2) : Device area of 9 axes or more is unusable in the Q172CPU(N).

(Note-3) : The range of axis No.1 to 8 is valid in the Q172CPU(N).

(Note-4) : It can also be ordered the device of a remark column.

(Note-5) : M3080 does not turn off automatically. Turn it off as an user side.

(Note-6) : It is unusable in the SV22 real mode.

⚠CAUTION

● The data executed later becomes effective when the same device is executed simultaneously in the Motion SFC and PLC program.

10) Table of the special relay allocated devices (Status) (SV13/SV22)

Device No.	Signal name	Refresh cycle	Fetch cycle	Signal direction	Remark[(Note)]
M2320	Fuse blown detection	Error occurrence		Status signal	M9000
M2321	AC/DC DOWN detection				M9005
M2322	Battery low				M9006
M2323	Battery low latch				M9007
M2324	Self-diagnostic error				M9008
M2325	Diagnostic error				M9010
M2326	Always ON	Main operation			M9036
M2327	Always OFF				M9037
M2328	Clock data error	Error occurrence			M9026
M2329	PCPU WDT error flag				M9073
M2330	PCPU READY complete flag	At request			M9074
M2331	Test mode ON flag				M9075
M2332	External forced stop input flag	Operation cycle			M9076
M2333	Manual pulse generator axis setting error flag	Error occurrence			M9077
M2334	TEST mode request error flag				M9078
M2335	Servo program setting error flag				M9079
M2336	CPU No.1 reset flag	At Status change			M9240
M2337	CPU No.2 reset flag				M9241
M2338	CPU No.3 reset flag				M9242
M2339	CPU No.4 reset flag				M9243
M2340	CPU No.1 error flag				M9244
M2341	CPU No.2 error flag				M9245
M2342	CPU No.3 error flag				M9246
M2343	CPU No.4 error flag				M9247
M2344	Servo parameter reading flag	At request			M9105
M2345	CPU No.1 MULTR complete flag	At instruction completion			M9216
M2346	CPU No.2 MULTR complete flag				M9217
M2347	CPU No.3 MULTR complete flag				M9218
M2348	CPU No.4 MULTR complete flag				M9219
M2349 to M2399	Unusable	—	—	—	—

(Note) : The same status as a remark column is output.

11) Table of the common devices (Command signal) (SV13/SV22)

Device No.	Signal name	Refresh cycle	Fetch cycle	Signal direction	Remark (Note-1) , (Note-2)
M3072	PLC ready flag		Main cycle	Command signal	M2000
M3073	Speed switching point specified flag		At start		M2040
M3074	All axes servo ON command		Operation cvcle		M2042
M3075	Real mode/virtual mode change request (SV22)		At virtual mode transition		M2043
M3076	JOG operation simultaneous start command		Main cycle		M2048
M3077	Manual pulse generator 1 enable flag				M2051
M3078	Manual pulse generator 2 enable flag				M2052
M3079	Manual pulse generator 3 enable flag				M2053
M3080	Motion SFC error history clear request flag (Note-3)				M2035
M3081 to M3135	Unusable	—	—	—	—

(Note-1) : The device of a remarks column turns ON by OFF to ON of the above device, and the device of a remarks column turns OFF by ON to OFF of the above device. The state of a device is not in agreement when the device of a remarks column is turned on directly. In addition, when the request from a data register and the request from the above device are performed simultaneously, the request from the above device becomes effective.

(Note-2) : It can also be ordered the device of a remark column.

(Note-3) : M3080 does not turn off automatically. Turn it off as an user side.

12) Table of the special relay allocated devices (Command signal) (SV13/SV22)

Device No.	Signal name	Refresh cycle	Fetch cycle	Signal direction	Remark (Note-1), (Note-2)
M3136	Clock data set request		Main cycle	Command signal	M9025
M3137	Clock data read request				M9028
M3138	Error reset				M9060
M3139	Servo parameter read request flag				M9104
M3140 to M3199	Unusable	—	—	—	—

(Note-1) : The device of a remarks column turns ON by OFF to ON of the above device, and the device of a remarks column turns OFF by ON to OFF of the above device. The state of a device is not in agreement when the device of a remarks column is turned on directly.

(Note-2) : It can also be ordered the device of a remark column.

(b) Table of the data registers

- Overall configuration

SV13		SV22	
Device No.	Application	Device No.	Application
D0 to	Axis monitor device (20 points × 32 axes)	D0 to	Axis monitor device (20 points × 32 axes) Real mode……Each axis Virtual mode….Output module
D640 to	Control change register (2 points × 32 axes)	D640 to	Control change register (2 points × 32 axes)
D704 to	Common device (Command signal) (54 points)	D704 to	Common device (Command signal) (54 points)
D758 to	Common device (Monitor) (42points)	D758 to	Common device (Monitor) (42points)
D800 to D8191	User device (7392 points)	D800 to	Virtual servomotor axis monitor device (Note) (10 points × 32 axes) (Mechanical system setting axis only)
		D1120 to	Syncronous encoder axis monitor device (Note) (10 points × 12 axes)
		D1240 to	Cam axis monitor device (Note) (10 points × 32 axes)
		D1560 to D8191	User device (6632 points)

(Note) : It can be used as an user device in the SV22 real mode only.

1) Table of the each axis monitor devices (SV13/SV22)

Device No.	Signal name	Device No.	Signal name
D0 to D19	Axis 1 monitor device	D320 to D339	Axis 17 monitor device
D20 to D39	Axis 2 monitor device	D340 to D359	Axis 18 monitor device
D40 to D59	Axis 3 monitor device	D360 to D379	Axis 19 monitor device
D60 to D79	Axis 4 monitor device	D380 to D399	Axis 20 monitor device
D80 to D99	Axis 5 monitor device	D400 to D419	Axis 21 monitor device
D100 to D119	Axis 6 monitor device	D420 to D439	Axis 22 monitor device
D120 to D139	Axis 7 monitor device	D440 to D459	Axis 23 monitor device
D140 to D159	Axis 8 monitor device	D460 to D479	Axis 24 monitor device
D160 to D179	Axis 9 monitor device	D480 to D499	Axis 25 monitor device
D180 to D199	Axis 10 monitor device	D500 to D519	Axis 26 monitor device
D200 to D219	Axis 11 monitor device	D520 to D539	Axis 27 monitor device
D220 to D239	Axis 12 monitor device	D540 to D559	Axis 28 monitor device
D240 to D259	Axis 13 monitor device	D560 to D579	Axis 29 monitor device
D260 to D279	Axis 14 monitor device	D580 to D599	Axis 30 monitor device
D280 to D299	Axis 15 monitor device	D600 to D619	Axis 31 monitor device
D300 to D319	Axis 16 monitor device	D620 to D639	Axis 32 monitor device

- Detailes of each axis

Device No.	SV13/SV22(Real mode)	SV22(Virtual mode)	Signal derection
D0 + 20n D1 + 20n	Feed current value	Feed current value/roller cycle speed	Monitor device
D2 + 20n D3 + 20n	Real current value	Real current value	
D4 + 20n D5 + 20n	Deviation counter value	Deviation counter value	
D6 + 20n	Minor error code	Minor error code	
D7 + 20n	Major error code	Major error code	
D8 + 20n	Servo error code	Servo error code	
D9 + 20n	Home position return re-travel value	Hold	
D10 + 20n D11 + 20n	Travel value after proximity dog ON	Hold	
D12 + 20n	Execute program No.	—	
D13 + 20n	M-code	—	
D14 + 20n	Torque limit value	Torque limit value	
D15 + 20n	Data set pointer for constant-speed control	—	
D16 + 20n D17 + 20n	Travel value change register	—	Command device
D18 + 20n D19 + 20n	Real current value at stop input	Hold	Monitor device

(Note-1) : "n" in the above device No. shows the numerical value which correspond to axis No.
Q173CPU(N) : Axis No.1 to No.32 (n=0 to 31)
Q172CPU(N) : Axis No.1 to No.8 (n=0 to 7)

(Note-2) : Device area of 9 axes or more is unusable in the Q172CPU(N).

2) Table of the control change registers (SV13/SV22)

Device No.	Signal name	Device No.	Signal name
D640 D641	Axis 1 JOG speed setting register	D672 D673	Axis 17 JOG speed setting register
D642 D643	Axis 2 JOG speed setting register	D674 D675	Axis 18 JOG speed setting register
D644 D645	Axis 3 JOG speed setting register	D676 D677	Axis 19 JOG speed setting register
D646 D647	Axis 4 JOG speed setting register	D678 D679	Axis 20 JOG speed setting register
D648 D649	Axis 5 JOG speed setting register	D680 D681	Axis 21 JOG speed setting register
D650 D651	Axis 6 JOG speed setting register	D682 D683	Axis 22 JOG speed setting register
D652 D653	Axis 7 JOG speed setting register	D684 D685	Axis 23 JOG speed setting register
D654 D655	Axis 8 JOG speed setting register	D686 D687	Axis 24 JOG speed setting register
D656 D657	Axis 9 JOG speed setting register	D688 D689	Axis 25 JOG speed setting register
D658 D659	Axis 10 JOG speed setting register	D690 D691	Axis 26 JOG speed setting register
D660 D661	Axis 11 JOG speed setting register	D692 D693	Axis 27 JOG speed setting register
D662 D663	Axis 12 JOG speed setting register	D694 D695	Axis 28 JOG speed setting register
D664 D665	Axis 13 JOG speed setting register	D696 D697	Axis 29 JOG speed setting register
D666 D667	Axis 14 JOG speed setting register	D698 D699	Axis 30 JOG speed setting register
D668 D669	Axis 15 JOG speed setting register	D700 D701	Axis 31 JOG speed setting register
D670 D671	Axis 16 JOG speed setting register	D702 D703	Axis 32 JOG speed setting register

MEMO

3) Table of the virtual servomotor axis monitor devices (SV22 only)

Device No.	Signal name	Device No.	Signal name
D800 to D809	Axis 1 monitor device	D960 to D969	Axis 17 monitor device
D810 to D819	Axis 2 monitor device	D970 to D979	Axis 18 monitor device
D820 to D829	Axis 3 monitor device	D980 to D989	Axis 19 monitor device
D830 to D839	Axis 4 monitor device	D990 to D999	Axis 20 monitor device
D840 to D849	Axis 5 monitor device	D1000 to D1009	Axis 21 monitor device
D850 to D859	Axis 6 monitor device	D1010 to D1019	Axis 22 monitor device
D860 to D869	Axis 7 monitor device	D1020 to D1029	Axis 23 monitor device
D870 to D879	Axis 8 monitor device	D1030 to D1039	Axis 24 monitor device
D880 to D889	Axis 9 monitor device	D1040 to D1049	Axis 25 monitor device
D890 to D899	Axis 10 monitor device	D1050 to D1059	Axis 26 monitor device
D900 to D909	Axis 11 monitor device	D1060 to D1069	Axis 27 monitor device
D910 to D919	Axis 12 monitor device	D1070 to D1079	Axis 28 monitor device
D920 to D929	Axis 13 monitor device	D1080 to D1089	Axis 29 monitor device
D930 to D939	Axis 14 monitor device	D1090 to D1099	Axis 30 monitor device
D940 to D949	Axis 15 monitor device	D1100 to D1109	Axis 31 monitor device
D950 to D959	Axis 16 monitor device	D1110 to D1119	Axis 32 monitor device

- Detailes of each axis

Device No.	Signal name
D800 + 10n D801 + 10n	Feed current value
D802 + 10n	Minor error code
D803 + 10n	Major error code
D804 + 10n	Execute program No.
D805 + 10n	M-code
D806 + 10n D807 + 10n	Current value after virtual sevomotor axis main shaft's differential gear
D808 + 10n	Error search output axis No.
D809 + 10n	Data set pointer for constant-speed control

(Note-1) : "n" in the above device No. shows the numerical value which correspond to axis No.
Q173CPU(N) : Axis No.1 to No.32 (n=0 to 31)
Q172CPU(N) : Axis No.1 to No.8 (n=0 to 7)

(Note-2) : The unused axis areas in the mechanical system program can be used as an user device.

4) Table of the synchronous encoder axis monitor devices (SV22 only)

Device No.	Signal name
D1120 to D1129	Axis 1 monitor device
D1130 to D1139	Axis 2 monitor device
D1140 to D1149	Axis 3 monitor device
D1150 to D1159	Axis 4 monitor device
D1160 to D1169	Axis 5 monitor device
D1170 to D1179	Axis 6 monitor device
D1180 to D1189	Axis 7 monitor device
D1190 to D1199	Axis 8 monitor device
D1200 to D1209	Axis 9 monitor device
D1210 to D1219	Axis 10 monitor device
D1220 to D1229	Axis 11 monitor device
D1230 to D1239	Axis 12 monitor device

- Detailes of each axis

Device No.	Signal name
D1120 + 10n D1121 + 10n	Current value
D1122 + 10n	Minor error code
D1123 + 10n	Major error code
D1124 + 10n	Unusable
D1125 + 10n	
D1126 + 10n D1127 + 10n	Current value after synchronous encoder axis main shaft's differential gear
D1128 + 10n	Error search output axis No.
D1129 + 10n	Unusable

(Note-1) : "n" in the above device No. shows the numerical value which correspond to axis No.

Q173CPU(N) : Axis No.1 to No.12 (n=0 to 11)

Q172CPU(N) : Axis No.1 to No.8 (n=0 to 7)

(Note-2) : Device area of 9 axes or more is unusable in the Q172CPU(N).

5) Table of the cam axis monitor devices (SV22 only)

Device No.	Signal name	Device No.	Signal name
D1240 to D1249	Axis 1 monitor device	D1400 to D1409	Axis 17 monitor device
D1250 to D1259	Axis 2 monitor device	D1410 to D1419	Axis 18 monitor device
D1260 to D1269	Axis 3 monitor device	D1420 to D1429	Axis 19 monitor device
D1270 to D1279	Axis 4 monitor device	D1430 to D1439	Axis 20 monitor device
D1280 to D1289	Axis 5 monitor device	D1440 to D1449	Axis 21 monitor device
D1290 to D1299	Axis 6 monitor device	D1450 to D1459	Axis 22 monitor device
D1300 to D1309	Axis 7 monitor device	D1460 to D1469	Axis 23 monitor device
D1310 to D1319	Axis 8 monitor device	D1470 to D1479	Axis 24 monitor device
D1320 to D1329	Axis 9 monitor device	D1480 to D1489	Axis 25 monitor device
D1330 to D1339	Axis 10 monitor device	D1490 to D1499	Axis 26 monitor device
D1340 to D1349	Axis 11 monitor device	D1500 to D1509	Axis 27 monitor device
D1350 to D1359	Axis 12 monitor device	D1510 to D1519	Axis 28 monitor device
D1360 to D1369	Axis 13 monitor device	D1520 to D1529	Axis 29 monitor device
D1370 to D1379	Axis 14 monitor device	D1530 to D1539	Axis 30 monitor device
D1380 to D1389	Axis 15 monitor device	D1540 to D1549	Axis 31 monitor device
D1390 to D1399	Axis 16 monitor device	D1550 to D1559	Axis 32 monitor device

- Detailes of each axis

Device No.	Signal name
D1240 + 10n	Unusable
D1241 + 10n	Execute cam No.
D1242 + 10n D1243 + 10n	Execute stroke amount
D1244 + 10n	Current value within 1 cam shaft revolution
D1245 + 10n	
D1246 + 10n	Unusable
D1247 + 10n	
D1248 + 10n	
D1249 + 10n	

(Note-1) : "n" in the above device No. shows the numerical value which correspond to axis No.
Q173CPU(N) : Axis No.1 to No.32 (n=0 to 31)
Q172CPU(N) : Axis No.1 to No.8 (n=0 to 7)

(Note-2) : The unused aixs areas in the mechanical system program can be used as an user device.

6) Table of the common devices (SV13/SV22)

Device No.	Signal name		Signal derecrtion
D704	PLC ready flag request		Command device
D705	Speed switching point specified flag request		
D706	All axes servo ON command request		
D707	Real mode/virtual mode switching request (SV22)		
D708	JOG operation simultaneous start command request		
D709	Unusable		—
D710 to D713	JOG operation simultaneous start axis setting register		Command device
D714 D715	Manual pulse generator axis 1 No. setting register		
D716 D717	Manual pulse generator axis 2 No. setting register		
D718 D719	Manual pulse generator axis 3 No. setting register		
D720	Axis 1	Manual pulse generators 1 pulse input magnification setting register (Note-1, 2)	
D721	Axis 2		
D722	Axis 3		
D723	Axis 4		
D724	Axis 5		
D725	Axis 6		
D726	Axis 7		
D727	Axis 8		
D728	Axis 9		
D729	Axis 10		
D730	Axis 11		
D731	Axis 12		
D732	Axis 13		
D733	Axis 14		
D734	Axis 15		
D735	Axis 16		
D736	Axis 17		
D737	Axis 18		
D738	Axis 19		
D739	Axis 20		

Device No.	Signal name		Signal derecrtion
D740	Axis 21	Manual pulse generators 1 pulse input magnification setting register (Note-1, 2)	Command device
D741	Axis 22		
D742	Axis 23		
D743	Axis 24		
D744	Axis 25		
D745	Axis 26		
D746	Axis 27		
D747	Axis 28		
D748	Axis 29		
D749	Axis 30		
D750	Axis 32		
D751	Axis 32		
D752	Manual pulse generator 1 smoothing magnification setting register		
D753	Manual pulse generator 2 smoothing magnification setting register		
D754	Manual pulse generator 3 smoothing magnification setting register		
D755	Manual pulse generator 1 enable flag request		
D756	Manual pulse generator 2 enable flag request		
D757	Manual pulse generator 3 enable flag request		
D758	Unusable		—
D759	PCPU ready complete flag status (0 : OFF/1 : ON)		Monitor device
D760 to D789	Unusable		—
D790	Real mode axis information register (SV22)		Monitor device
D791			
D792 to D799	Servo amplifier type		

(Note-1) : The range of axis No.1 to 8 is valid in the Q172CPU(N).

(Note-2) : Device area of 9 axes or more is unusable in the Q172CPU(N).

(2) Special relays

Special relays are internal relays whose applications are fixed in the Motion CPU. For this reason, they cannot be used in the same way as the normal internal relays by the Motion SFC programs.
However, they can be turned ON/OFF as needed in order to control the Motion CPU.

The headings in the table that follows have the following meanings.

Item	Explanation
No.	• Indicates the device No. of the special relay.
Name	• Indicates the name of the special relay.
Meaning	• Indicates the nature of the special relay.
Details	• Indicates detailed information about the nature of the special relay.
Set by (When set)	• Indicates whether the relay is set by the system or user, and, if it is set by system, when setting is performed. <Set by> S : Set by system (Motion CPU) U : Set by user (Motion SFC program or test operation using a peripheral device) S/U : Set by both system (Motion CPU) and user <When set> Indicated only if setting is done by system (Motion CPU) . Main process : Set during each main processing (free time processing of the CPU) Initial process : Set only during initial processing (when power supply is turned ON, or when executed the reset) Status change : Set only when there is a change in status Error : Set when error is occurred. Request : Set only when there is a user request (Special reray, etc.) Operation cycle : Set during each operation cycle of the Motion CPU.

Special relay list

No.	Name	Meaning	Details	Set by (When set)	Remark
M9000	Fuse blown detection flag	OFF : Normal ON : Fuse blown module detected	• Turn on when there is one or more output modules control of self CPU which fuse has been blown. Remains on if normal status is restored.	S(Occur an error)	
M9005	AC/DC DOWN detection flag	OFF : AC/DC DOWN not detected ON : AC/DC DOWN detected	• Turn on if a momentary power interruption of less than 20ms occurred during use of the AC power supply module, and reset by turning power off to on. • Turn on if a momentary power interruption of less than 10ms occurred during use of the DC power supply module, and reset by turning power off to on.		
M9006	Battery low flag	OFF : Normal ON : Battery low	• Turned on when the voltage of the external battery reduces to less than specified value. Turn off when the voltage of the external battery becomes normal. • Synchronizes with "BAT. LED" • Check the voltage of the external battery, only when it is set with "external battery use" by system setting.		
M9007	Battery low latch flag	OFF : Normal ON : Battery low	• Turn on when the voltage of the external battery reduces to less than specified value. Remains on if normal status is restored. • Synchronizes with "BAT. LED" • Check the voltage of the external battery, only when it is set with "external battery use" by system setting.		
M9008	Self-diagnostic error flag	OFF : No error ON : Error	• Turn on when error is found as a result of self-diagnosis. Remains on if normal status is restored.		
M9010	Diagnostic error flag	OFF : No error ON : Error	• Turn on when error is found as a result of diagnosis. Remains on if normal status is restored.		New (Note-1)
M9025	Clock data set request	OFF : Ignored ON : Set request present used	• Write clock data stored in D9025 to D9028 to the clock element when M9025 has changed from off to on.	U	
M9026	Clock data error	OFF : No error ON : Error	• Turn on by clock data (D9025 to D9028) error.	S(Request)	
M9028	Clock data read request	OFF : Ignored ON : Read request	• Read clock data from D9025 to D9028 in BCD when M9028 is on.	U	
M9036	Always ON	ON ———— OFF	• Turn on without regard to position of RUN/STOP switch on.	S(Main processing)	
M9037	Always OFF	ON OFF ————	• Turn off without regard to position of RUN/STOP switch on.		
M9060	Diagnostic error reset	OFF → ON : Diagnostic error reset	• A reset of the diagnostic error is executed.	U	New (Note-1)
M9073	PCPU WDT error flag	ON : Abnormal OFF : Normal	• Turn on when a "watchdog timer error" is detected by the Motion CPU self-diagnosis function. When the Motion CPU detects a WDT error, it executes an immediate stop without deceleration of the operating axes. • The error cause is stored in the "Motion CPU WDT error cause (D9184)".	S(Occur an error)	
M9074	PCPU READY complete flag	ON : PCPU READY completion OFF : PCPU READY uncompletion	• When the PLC ready flag (M2000) turn off to on, the fixed parameters, servo parameters and limit switch output data, etc., are checked, and if no error is detected this flag turns on. • Turn off when the PLC ready (M2000) signal turns off.	S(Request)	
M9075	Test mode ON flag	ON : TEST mode is in effect. OFF : TEST mode is not in effect.	• This flag status indicates whether a TEST mode established from a peripheral device is currently in effect. • If the TEST mode is not established in response to a TEST mode request from a peripheral device, the "TEST mode request error flag (M9078)" will turn on.	S(Request)	
M9076	External forced stop input flag	ON : Forced stop OFF OFF : Forced stop ON	• This flag status indicate whether the forced stop.	S(Operation cycle)	

(Note-1) : It adds newly at the Motion controller Q series.

Special relay list (continued)

No.	Name	Meaning	Details	Set by (When set)	Remark
M9077	Manual pulse generator axis setting error flag	ON : At least one D714 to D719 setting is abnormal. OFF : All D714 to D719 settings are normal.	• This flag indicates whether the setting designated at the manual pulse generator axis setting register (D714 to D719) is normal or abnormal. • When this relay turn on, the error content is stored at the manual pulse generator axis setting error register (D9185 to D9187).	S(Occur an error)	
M9078	TEST mode request error flag	ON : Abnormal OFF : Normal	• Turn on if the TEST mode is not established in response to a TEST mode request from a peripheral device. • When this relay turns on, the error content is stored at the TEST mode request error register (D9182 to D9183).	S(Occur an error)	
M9079	Servo program setting error flag	ON : Abnormal OFF : Normal	• This flag status indicates whether the positioning data of the servo program(K) specified with the Motion SFC program is normal or abnormal, and if error is detected this flag turns on. • The content of a servo program setting error is stored at D9189 and D9190.	S(Occur an error)	
M9104	Servo parameter read request flag	OFF to ON : Servo parameter read	• The servo parameter of servo parameter read request axis set as D9104 is reflected in the Motion CPU from the servo amplifier at the time of OFF to ON.	U	New (Note-1)
M9105	Servo parameter reading flag	ON : Servo parameter reading. OFF : Except servo parameter reading.	• This flag turn on while having read the servo amplifier to the Motion CPU. It turn off automatically after reading completion.	S(Reading)	
M9216	CPU No.1 MULTR complete flag	OFF to ON : CPU No.1 read completion	• Turn on when the data read from CPU No.1 is performed normally by MULTR instruction.	S(Read completion)	
M9217	CPU No.2 MULTR complete flag	OFF to ON : CPU No.2 read completion	• Turn on when the data read from CPU No.2 is performed normally by MULTR instruction.		
M9218	CPU No.3 MULTR complete flag	OFF to ON : CPU No.3 read completion	• Turn on when the data read from CPU No.3 is performed normally by MULTR instruction.		
M9219	CPU No.4 MULTR complete flag	OFF to ON : CPU No.4 read completion	• Turn on when the data read from CPU No.4 is performed normally by MULTR instruction.		
M9240	CPU No.1 resetting flag	OFF : CPU No.1 reset release ON : CPU No.1 resetting	• Turn off at reset release of the CPU No.1. • Turn on during reset of the CPU No.1. (It also contains when a CPU is removed from the base unit.) • The other CPU is also resetting.	S(Change status)	
M9241	CPU No.2 resetting flag	OFF : CPU No.2 reset release ON : CPU No.2 resetting	• Turn off at reset release of the CPU No.2. • Turn on during reset of the CPU No.2. (It also contains when a CPU is removed from the base unit.) • The error of the "MULTI CPU DOWN" (error code : 7000) occurs in the other CPU.		
M9242	CPU No.3 resetting flag	OFF : CPU No.3 reset release ON : CPU No.3 resetting	• Turn off at reset release of the CPU No.3. • Turn on during reset of the CPU No.3. (It also contains when a CPU is removed from the base unit.) • The error of the "MULTI CPU DOWN" (error code : 7000) occurs in the other CPU.		
M9243	CPU No.4 resetting flag	OFF : CPU No.4 reset release ON : CPU No.4 resetting	• Turn off at reset release of the CPU No.4. • Turn on during reset of the CPU No.4. (It also contains when a CPU is removed from the base unit.) • The error of the "MULTI CPU DOWN" (error code : 7000) occurs in the other CPU.		

(Note-1) : It adds newly at the Motion controller Q series.

(Note-2) : The CPU No.1 is reset after the factor of the stop error is removed to cancel a stop error. → Resetting is cancelled.

Special relay list (continued)

No.	Name	Meaning	Details	Set by (When set)	Remark
M9244	CPU No.1 error flag	OFF : CPU No.1 normal ON : On CPU No.1 stop error	• Turn off when the CPU No.1 is normal. (It contains at continuation error.) • Turn on during stop error of the CPU No.1. (Note-2)	S(Change status)	New (Note-1)
M9245	CPU No.2 error flag	OFF : CPU No.2 normal ON : On CPU No.2 stop error	• Turn off when the CPU No.2 is normal. (It contains at continuation error.) • Turn on during stop error of the CPU No.2. (Note-2)		
M9246	CPU No.3 error flag	OFF : CPU No.3 normal ON : On CPU No.3 stop error	• Turn off when the CPU No.3 is normal. (It contains at continuation error.) • Turn on during stop error of the CPU No.3. (Note-2)		
M9247	CPU No.4 error flag	OFF : CPU No.4 normal ON : On CPU No.4 stop error	• Turn off when the CPU No.4 is normal. (It contains at continuation error.) • Turn on during stop error of the CPU No.4. (Note-2)		

(Note-1) : It adds newly at the Motion controller Q series.

(Note-2) : The CPU No.1 is reset after the factor of the stop error is removed to cancel a stop error. → Resetting is cancelled.

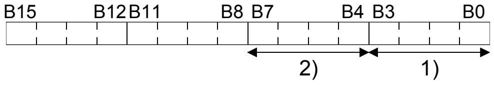
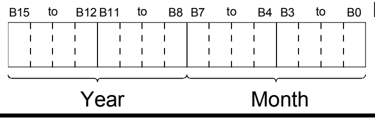
(3) Special registers

Special registers are internal registers whose applications are fixed in the Motion CPU. For this reason, it is not possible to use these registers in Motion SFC programs in the same way that normal registers are used.
However, data can be written as needed in order to control the Motion CPU.
Data stored in the special registers are stored as BIN values if no special designation has been made to the contrary.

The headings in the table that follows have the following meanings.

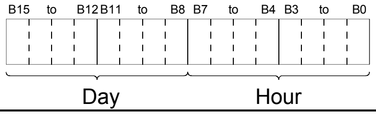
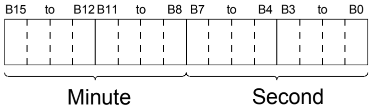
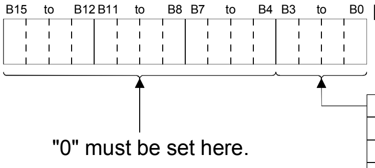
Item	Explanation
Number	• Indicates the No. of the special register.
Name	• Indicates the name of the special register.
Meaning	• Indicates the nature of the special register.
Details	• Indicates detailed information about the nature of the special register.
Set by (When set)	• Indicates whether the register is set by the system or user, and, if it is set by system, when setting is performed. <Set by> S : Set by system (Motion CPU) U : Set by user (Motion SFC program or test operation using a peripheral device) S/U : Set by both system (Motion CPU) and user <When set> Indicated only if setting is done by system (Motion CPU) . Main process : Set during each main processing (free time processing of the CPU) Initial process : Set only during initial processing (when power supply is turned ON, or when executed the reset) Status change : Set only when there is a change in status Error : Set when error is occurred. Request : Set only when there is a user request (Special reray , etc.) Operation cycle : Set during each operation cycle of the Motion CPU.

Special register list

No.	Name	Meaning	Details	Set by (When set)	Remark
D9000	Fuse blown No.	Module No. with blown fuse	• When fuse blown modules are detected, the lowest I/O module No. is stored in D9000.	S(Occur an error)	
D9005	AC/DC DOWN counter No.	Number of times for AC/DC DOWN	• 1 is added to the stored value each time the input voltage becomes 85[%](AC power supply/65[%] DC power supply) or less of the rating while the CPU module is performing an operation, and the value is stored in BIN code.		
D9008	Diagnostic error	Dignostic error number	• When error is found as a result of self-diagnosis, error No. is stored in BIN code. • Refer to "19.4 Multiple CPU Error Codes" for details of the error code.		
D9010	Diagnostic error occurrence time	Diagnostic error occurrence (Year, Month)	• The age (A.D, the rightmost two digits) when data on D9008 are updated, and the month stored with a BCD code two digits. B15 to B8 B7 to B0 Year(0 to 99) | Month(1 to 12) Example : October 1995 H9510		New (Note)
D9011		Diagnostic error occurrence time (Day, Hour)	• The day when data on D9008 are updated, and the hour stored with a BCD code two digits. B15 to B8 B7 to B0 Day(1 to 31) | Hour(0 to 23) Example : 25st, 10 a.m H2510		
D9012		Diagnostic error occurrence time (Minute, Second)	• The minute when data on D9008 are updated, and the second stored with a BCD code two digits. B15 to B8 B7 to B0 Minute(0 to 59) | Second(0 to 59) Example : 35 min., 48 sec. H3548		
D9013	Error information classfication	Error information classfication code	• The classification code to judge the error information stored in the eror information (D9014) is stored. • The following code is stored. 0 : None 1 : Module No./CPU No./Base No. 2 : Parameter No.		
D9014	Error information	Error information	• Error information to comply with the diagnostic error (D9008) is stored. There are following two types informations to be stored. 1) Module No./CPU No./Base No. • Module No. or CPU No. is stored according to the error which occurred in the case of the Multiple CPU system. (Refer to each error code which is stored.) CPU No.1 : 1, CPU No.2 : 2, CPU No.3 : 3, CPU No.4 : 4 2) Parameter No.		
D9015	Operating state of CPU	Operating state of CPU	• The operation states of CPU as shown below are stored in D9015.  1) Operating state of CPU — 0 : RUN, 2 : STOP 2) STOP cause — 0 : RUN/STOP switch, 4 : Error Note : Priority is earliest first	S(Main processing)	
D9017	Scan time	Scan time (1ms units)	• Main cycle is stored in the unit 1ms. • Setting range (0 to 65535[ms])		New (Note)
D9019	Maximum scan time	Maximum scan time (1ms units)	• The maximum value of the main cycle is stored in the unit 1ms. • Setting range (0 to 65535[ms])		
D9025	Clock data	Clock data (Year, month)	• Stores the year (2 lower digits) and month in BCD.  Example : July,1993 H9307	S/U(Request)	

(Note) : It adds newly at the Motion controller Q series.

Special register list (continued)

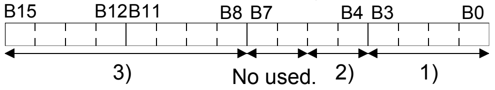
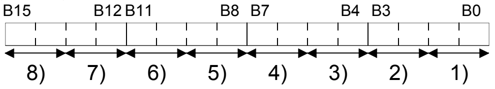
No.	Name	Meaning	Details	Set by (When set)	Remark
D9026	Clock data	Clock data (Day, hour)	• Stores the day and hour in BCD.  Example : 31st, 10 a.m. H3110	S/U(Request)	
D9027	Clock data	Clock data (Minute, second)	• Stores the minute and second in BCD.  Example : 35 min., 48 sec. H3548		
D9028	Clock data	Clock data (Day of week)	• Stores the day of the week in BCD.  B15 to B12 B11 to B8 B7 to B4 B3 to B0 "0" must be set here. Example : Friday H0005 Day of week 0 Sunday 1 Monday 2 Tuesday 3 Wednesday 4 Thursday 5 Friday 6 Saturday		
D9060	Diagnostic error reset error No.	Error No. of releasing an error	• Error No. of canceling error is stored.	U	New (Note)
D9061	Multiple CPU No.	Multiple CPU No.	• CPU No. of the self CPU is stored.	S(Initial processing)	

D9104	Servo parameter read request axis No.	Servo parameter read axis No.	• Axis No. of servo amplifier which begins to read servo parameter is setting.
			Q173CPU(N) : 1 to 32 (Axis1 to 32)
			Q172CPU(N) : 1 to 8 (Axis1 to 8)
				U	

D9182 D9183	Test mode request error	It is operating in requirement error occurrence of the test mode, axis information	• Each axis is stopping : 0/Operating : 1, information is stored as a bit data. D9182 : b0 to b15(Axis 1 to Axis 16) D9183 : b0 to b15(Axis 17 to Axis 32)	S(Occur an error)	
D9184	Motion CPU WDT error cause	Error meaning of WDT error occurs	The following error codes are stored in D9184. 1 : S/W fault 1 2 : Operation cycle over 3 : Q bus WDT error 4 : WDT error 30 : Information processor H/W error 201 to 215 : Q bus H/W fault 250 to 253 : Servo amplifier interface H/W fault 300 : S/W fault3 301 : 15 CPSTART instructions of 8 or more points were started simultaneously. 302 : During ROM operation, system setting data, program and parameter written to internal FLASH ROM are fault.		
D9185 D9186 D9187	Manual pulse generator axis setting error	Manual pulse generator axis setting error information	• Contents of the manual pulse generator axis setting error is stored when the manual pulse generator axis setting error flag(M9077) turn on. (Normal : 0/Setting error : 1) D9185 : The manual pulse generator axis setting error is stored in b0 to b2 (P1 to P3). The smoothing magnification setting is stored in b3 to b5 (P1 to P3). D9186 : One pulse input magnification setting error is stored in b0 to b15 (axis 1 to axis 16). D9187 : One pulse input magnification setting error is stored in b0 to b15 (axis 17 to axis 32).		

(Note) : It adds newly at the Motion controller Q series.

Special register list (continued)

No.	Name	Meaning	Details	Set by (When set)	Remark
D9188	Motion operation cycle	Motion operation cycle	• The time when the motion operation cycle is stored in the [μs] unit.	S(Operation cycle)	New (Note)
D9189	Error program No.	Error program No. of servo program	When the servo program setting error flag (M9079) turns on, the erroneous servo program No. will be stored.	S(Occur an error)	
D9190	Error item information	Error code of servo program	When the servo program setting error flag (M9079) turns on, the error code corresponding to the erroneous setting item will be stored.		
D9191 D9192	Servo amplifier loading information	Servo amplifier loading information	• The loading status(loading : 1/non-loading : 0) of the servo amplifier checked in initial process, and stored as the bit data. D9191 : b0 to b15(axis 1 to axis 16) D9192 : b0 to b15(axis 17 to axis 32) • The axis which turned from non-loading to loading status after power-on is handled as loaded. (However, the axis which turned from loading to non-loading status remains as loaded.)	S(Initial processing)	
D9193 D9194 D9195	Real mode/virtual mode switching error information	Real mode/virtual mode Switching error code	• When a mode switching error occurs in real-to-virtual or virtual-to-real mode switching, or a mode continuation error occurs in the virtual mode, its error information is stored.	S(Occur an error)	
D9196	PC link communication error codes	PC link communication error codes	• The following error code is stored. 00 : No error 01 : Receiving timing error 02 : CRC error 03 : Communication response code error 04 : Received frame error 05 : Communication task start error (Each error code is reset to "00" when normal communication is restarted.)		
D9197	Operation cycle of the Motion CPU setting	Operation cycle of the Motion CPU setting	• The time when the setting operation cycle is stroed in the [μs] unit.	S(Initial processing)	New (Note)
D9200	State of switch	State of CPU switch	• The CPU switch status is stored in the following format.  1) CPU switch status 0 : RUN 1 : STOP 2 : L.CLR 2) Memory card switch Always OFF 3) Dip switch B8 through B12 correspond to SW1 through SW5 of system setting switch 1. 0 : OFF/1 : ON B13 through B15 is not used.	S(Main processing)	
D9201	State of LED	State of CPU-LED	• Information concerning which of the following states the LEDs on the CPU are in is stored in the following bit patterns. • 0 is off, 1 is on, and 2 is flicker  1) : RUN 5) : BOOT 2) : ERROR 6) : No used 3) : M.RUN 7) : No used 4) : BAT.ALARM 8) : MODE Bit patterns for MODE 0 : OFF 1 : Green 2 : Orange	S(Change status)	New (Note)

(Note) : It adds newly at the Motion controller Q series.

1.3 Hardware Configuration

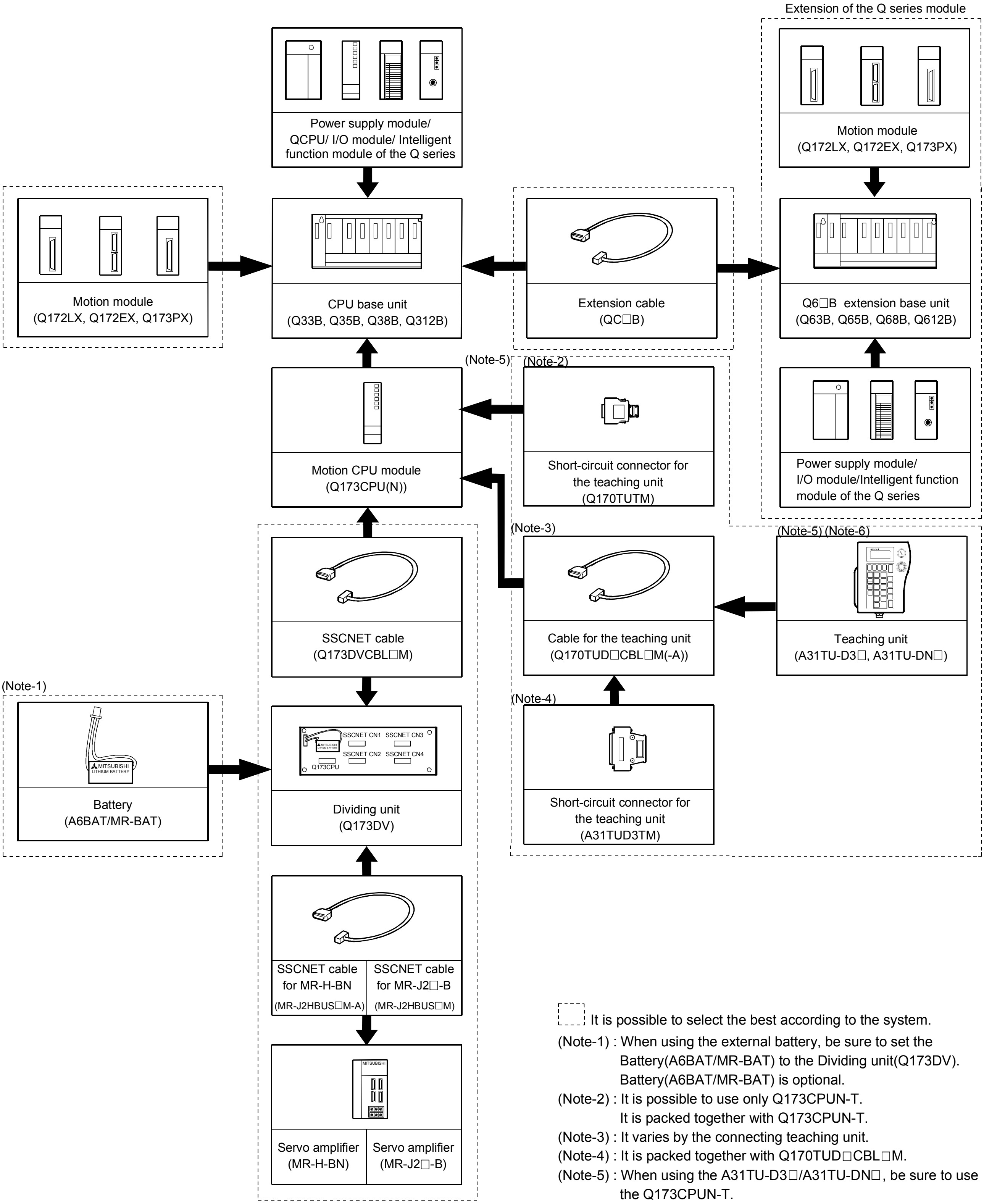
This section describes the Q173CPU(N)/Q172CPU(N) system configuration, precautions on use of system and configured equipments.

1.3.1 Motion system configuration

This section describes the equipment configuration, configuration with peripheral devices and system configuration in the Q173CPU(N)/Q172CPU(N) system.

(1) Equipment configuration in Q173CPU(N) system

(a) When using the Dividing unit/external battery


Extension of the Q series module
Power supply module/ QCPU/ I/O module/ Intelligent function module of the Q series
Motion module (Q172LX, Q172EX, Q173PX)
Motion module (Q172LX, Q172EX, Q173PX)
CPU base unit (Q33B, Q35B, Q38B, Q312B)
Extension cable (QC□B)
Q6□B extension base unit (Q63B, Q65B, Q68B, Q612B)
(Note-5) (Note-2)
Motion CPU module (Q173CPU(N))
Short-circuit connector for the teaching unit (Q170TUTM)
Power supply module/ I/O module/Intelligent function module of the Q series
(Note-3)
(Note-5) (Note-6)
SSCNET cable (Q173DVCBL□M)
Cable for the teaching unit (Q170TUD□CBL□M(-A))
Teaching unit (A31TU-D3□, A31TU-DN□)
(Note-1)
(Note-4)
Battery (A6BAT/MR-BAT)
MITSUBISHI LITHIUM BATTERY
SSCNET CN1 SSCNET CN3
SSCNET CN2 SSCNET CN4
Q173CPU
Dividing unit (Q173DV)
Short-circuit connector for the teaching unit (A31TUD3TM)
SSCNET cable for MR-H-BN (MR-J2HBUS□M-A)
SSCNET cable for MR-J2□-B (MR-J2HBUS□M)
MITSUBISHI
Servo amplifier (MR-H-BN)
Servo amplifier (MR-J2□-B)

┆ ┆ It is possible to select the best according to the system.

(Note-1) : When using the external battery, be sure to set the Battery(A6BAT/MR-BAT) to the Dividing unit(Q173DV). Battery(A6BAT/MR-BAT) is optional.

(Note-2) : It is possible to use only Q173CPUN-T. It is packed together with Q173CPUN-T.

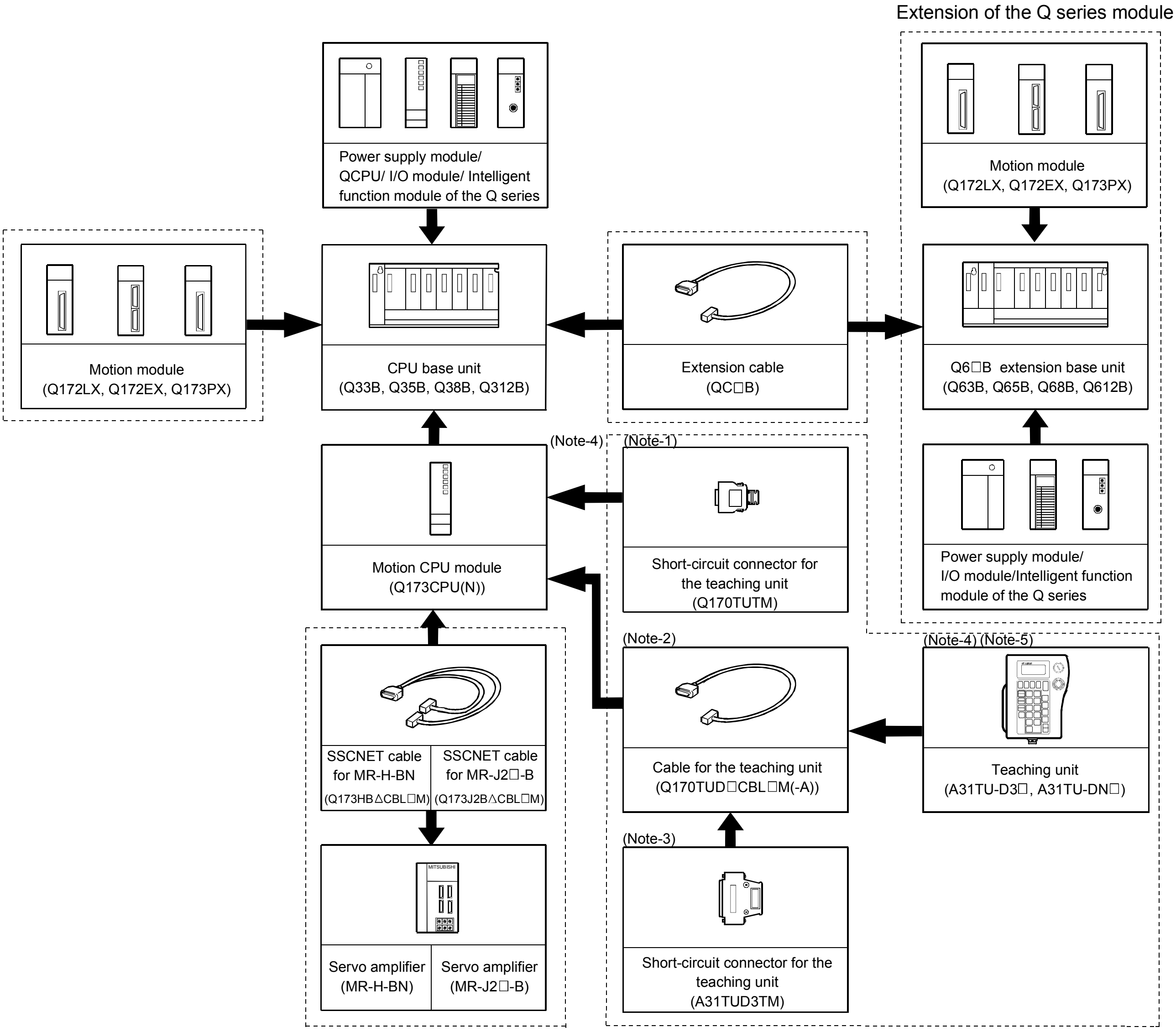
(Note-3) : It varies by the connecting teaching unit.

(Note-4) : It is packed together with Q170TUD□CBL□M.

(Note-5) : When using the A31TU-D3□/A31TU-DN□, be sure to use the Q173CPUN-T.

(Note-6) : A31TU-D3□/A31TU-DN□ corresponds to only Japanese. It does not correspond to display for English.

(b) When using the Dividing cable


Extension of the Q series module
Power supply module/ QCPU/ I/O module/ Intelligent function module of the Q series
Motion module (Q172LX, Q172EX, Q173PX)
Motion module (Q172LX, Q172EX, Q173PX)
CPU base unit (Q33B, Q35B, Q38B, Q312B)
Extension cable (QC□B)
Q6□B extension base unit (Q63B, Q65B, Q68B, Q612B)
(Note-4)
(Note-1)
Motion CPU module (Q173CPU(N))
Short-circuit connector for the teaching unit (Q170TUTM)
Power supply module/ I/O module/Intelligent function module of the Q series
(Note-2)
(Note-4) (Note-5)
SSCNET cable for MR-H-BN (Q173HB△CBL□M)
SSCNET cable for MR-J2□-B (Q173J2B△CBL□M)
Cable for the teaching unit (Q170TUD□CBL□M(-A))
Teaching unit (A31TU-D3□, A31TU-DN□)
(Note-3)
MITSUBISHI
Servo amplifier (MR-H-BN)
Servo amplifier (MR-J2□-B)
Short-circuit connector for the teaching unit (A31TUD3TM)

⬚ It is possible to select the best according to the system.

(Note-1) : It is possible to use only Q173CPUN-T. It is packed together with Q173CPUN-T.

(Note-2) : It varies by the connecting teaching unit.

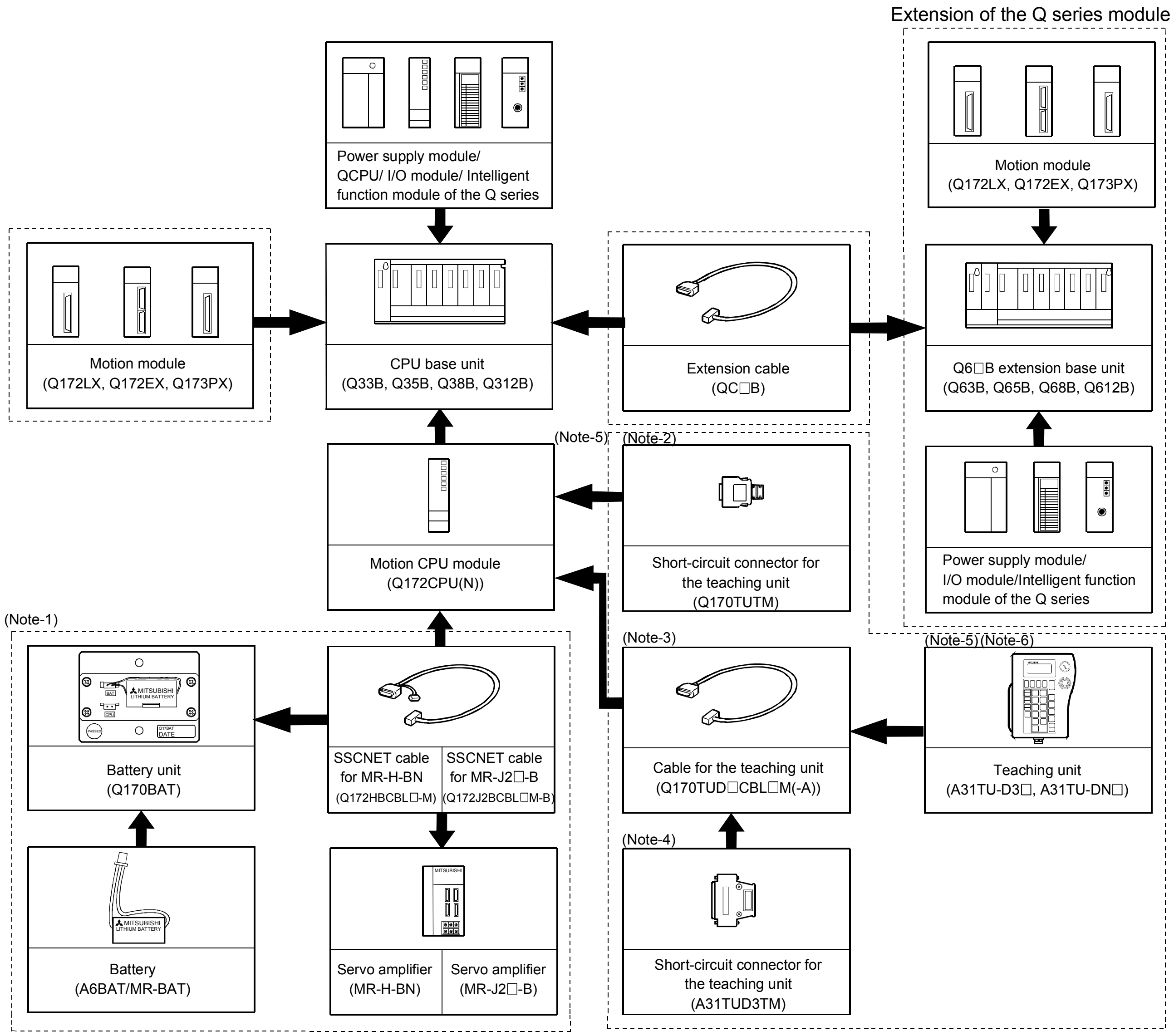
(Note-3) : It is packed together with Q170TUD□CBL□M.

(Note-4) : When using the A31TU-D3□/A31TU-DN□, be sure to use the Q173CPUN-T.

(Note-5) : A31TU-D3□/A31TU-DN□ corresponds to only Japanese. It does not correspond to display for English.

(2) Equipment configuration in Q172CPU(N) system

(a) When using the external battery


Extension of the Q series module
Power supply module/ QCPU/ I/O module/ Intelligent function module of the Q series
Motion module (Q172LX, Q172EX, Q173PX)
Motion module (Q172LX, Q172EX, Q173PX)
CPU base unit (Q33B, Q35B, Q38B, Q312B)
Extension cable (QC□B)
Q6□B extension base unit (Q63B, Q65B, Q68B, Q612B)
(Note-5)
(Note-2)
Motion CPU module (Q172CPU(N))
Short-circuit connector for the teaching unit (Q170TUTM)
Power supply module/ I/O module/Intelligent function module of the Q series
(Note-1)
(Note-3)
(Note-5) (Note-6)
MITSUBISHI LITHIUM BATTERY
Q170BAT DATE
Battery unit (Q170BAT)
SSCNET cable for MR-H-BN (Q172HBCBL□-M)
SSCNET cable for MR-J2□-B (Q172J2BCBL□M-B)
Cable for the teaching unit (Q170TUD□CBL□M(-A))
Teaching unit (A31TU-D3□, A31TU-DN□)
(Note-4)
Battery (A6BAT/MR-BAT)
MITSUBISHI
Servo amplifier (MR-H-BN)
Servo amplifier (MR-J2□-B)
Short-circuit connector for the teaching unit (A31TUD3TM)

⬚ It is possible to select the best according to the system.

(Note-1) : When using the external battery, be sure to use the SSCNET cable(Q172J2BCBL□M-B/Q172HBCBL□M-B) and to set the battery (A6BAT/MR-BAT). Also install the battery(A6BAT/MR-BAT)in the Battery unit(Q170BAT). Battery(A6BAT/MR-BAT) is optional.

(Note-2) : It is possible to use only Q172CPUN-T. It is packed together with Q172CPUN-T.

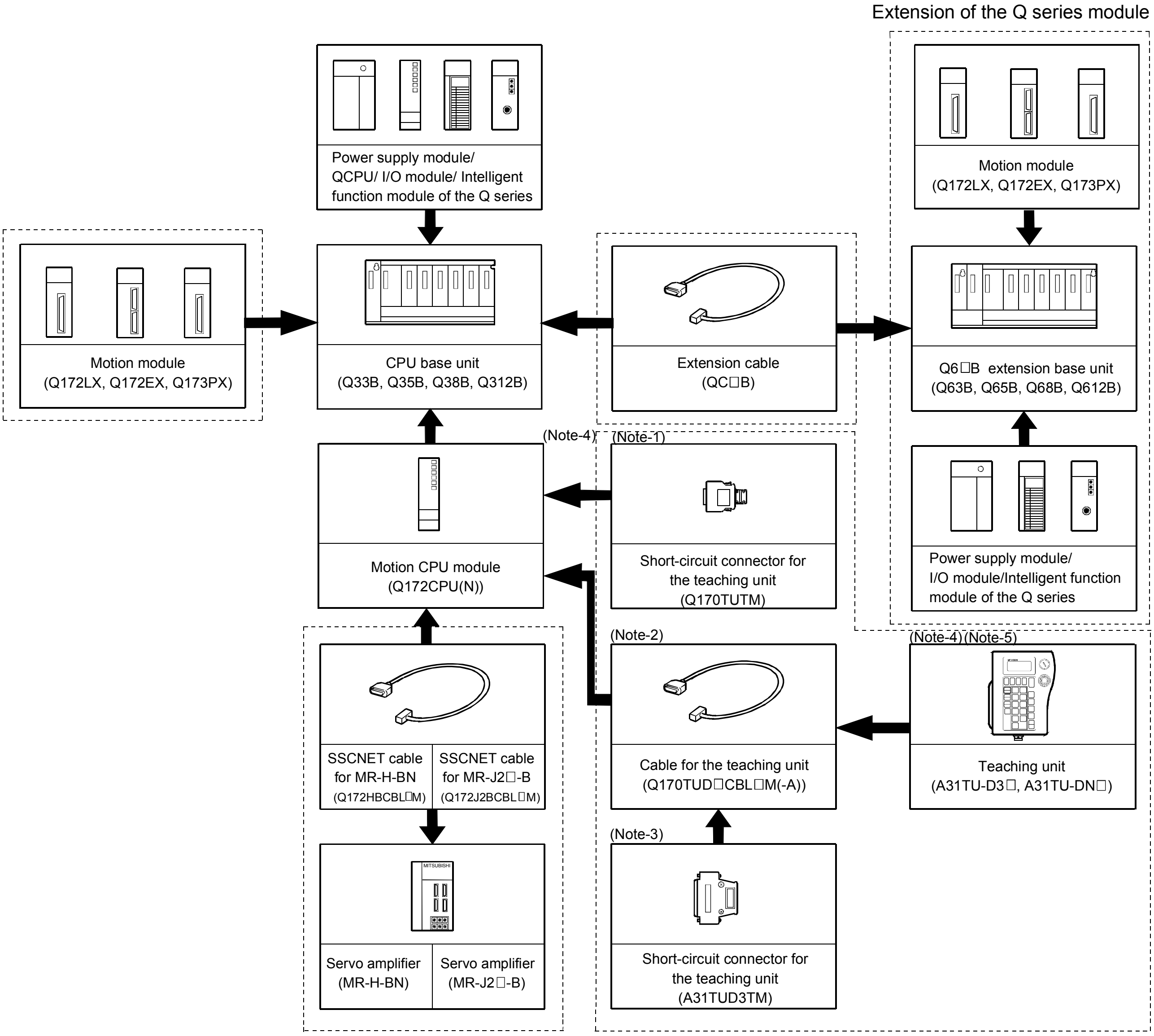
(Note-3) : It varies by the connecting teaching unit.

(Note-4) : It is packed together with Q170TUD□CBL□M.

(Note-5) : When using the A31TU-D3□/A31TU-DN□, be sure to use the Q172CPUN-T.

(Note-6) : A31TU-D3□/A31TU-DN□ corresponds to only Japanese. It does not correspond to display for English.

(b) When not using the external battery


Extension of the Q series module
Power supply module/ QCPU/ I/O module/ Intelligent function module of the Q series
Motion module (Q172LX, Q172EX, Q173PX)
CPU base unit (Q33B, Q35B, Q38B, Q312B)
Extension cable (QC□B)
Motion module (Q172LX, Q172EX, Q173PX)
Q6□B extension base unit (Q63B, Q65B, Q68B, Q612B)
(Note-4)
(Note-1)
Motion CPU module (Q172CPU(N))
Short-circuit connector for the teaching unit (Q170TUTM)
Power supply module/ I/O module/Intelligent function module of the Q series
(Note-2)
(Note-4)(Note-5)
SSCNET cable for MR-H-BN (Q172HBCBL□M)
SSCNET cable for MR-J2□-B (Q172J2BCBL□M)
Cable for the teaching unit (Q170TUD□CBL□M(-A))
Teaching unit (A31TU-D3□, A31TU-DN□)
(Note-3)
MITSUBISHI
Servo amplifier (MR-H-BN)
Servo amplifier (MR-J2□-B)
Short-circuit connector for the teaching unit (A31TUD3TM)

It is possible to select the best according to the system.

(Note-1) : It is possible to use only Q172CPUN-T. It is packed together with Q172CPUN-T.

(Note-2) : It varies by the connecting teaching unit.

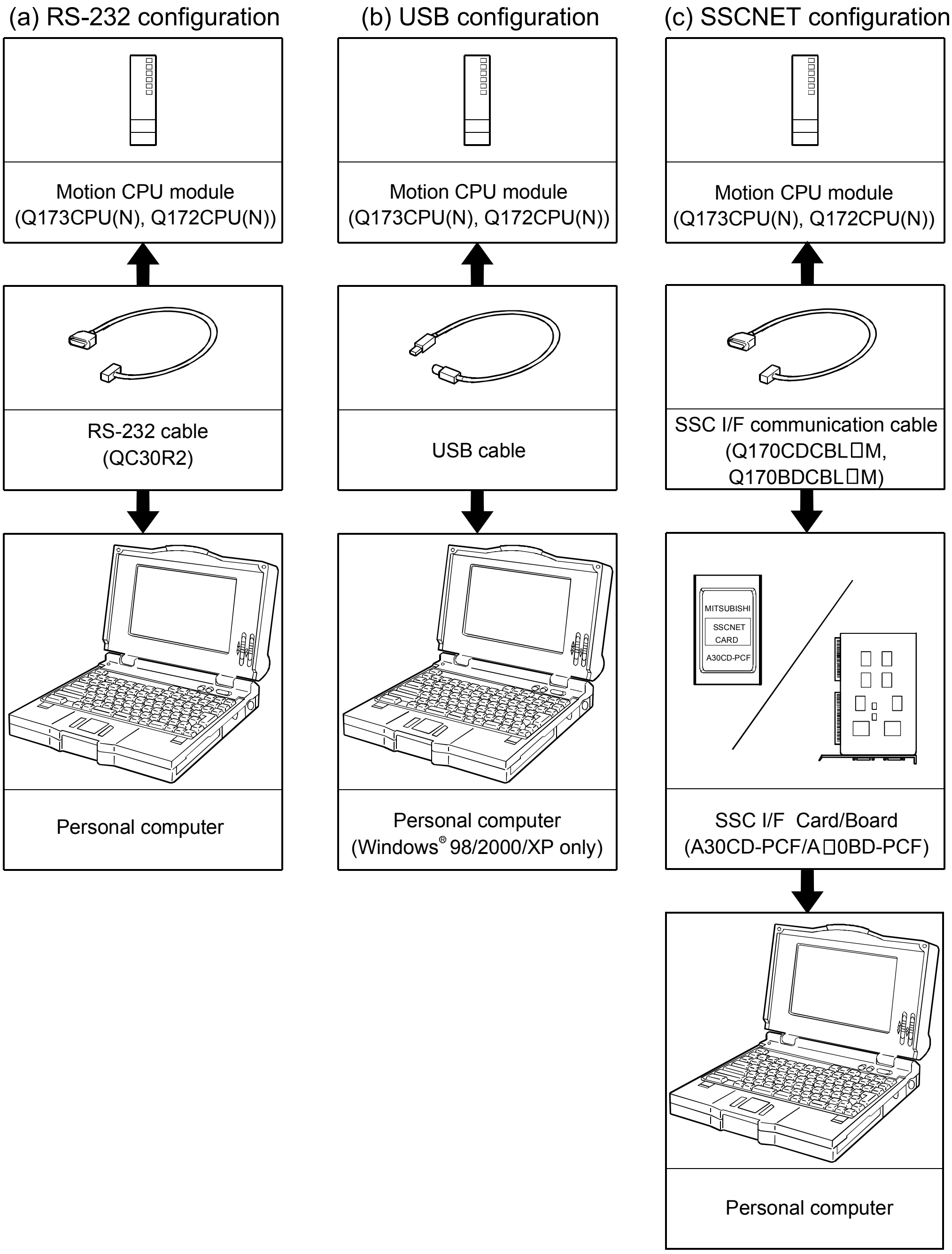
(Note-3) : It is packed together with Q170TUD□CBL□M.

(Note-4) : When using the A31TU-D3□/A31TU-DN□, be sure to use the Q172CPUN-T.

(Note-5) : A31TU-D3□/A31TU-DN□ corresponds to only Japanese. It does not correspond to display for English.

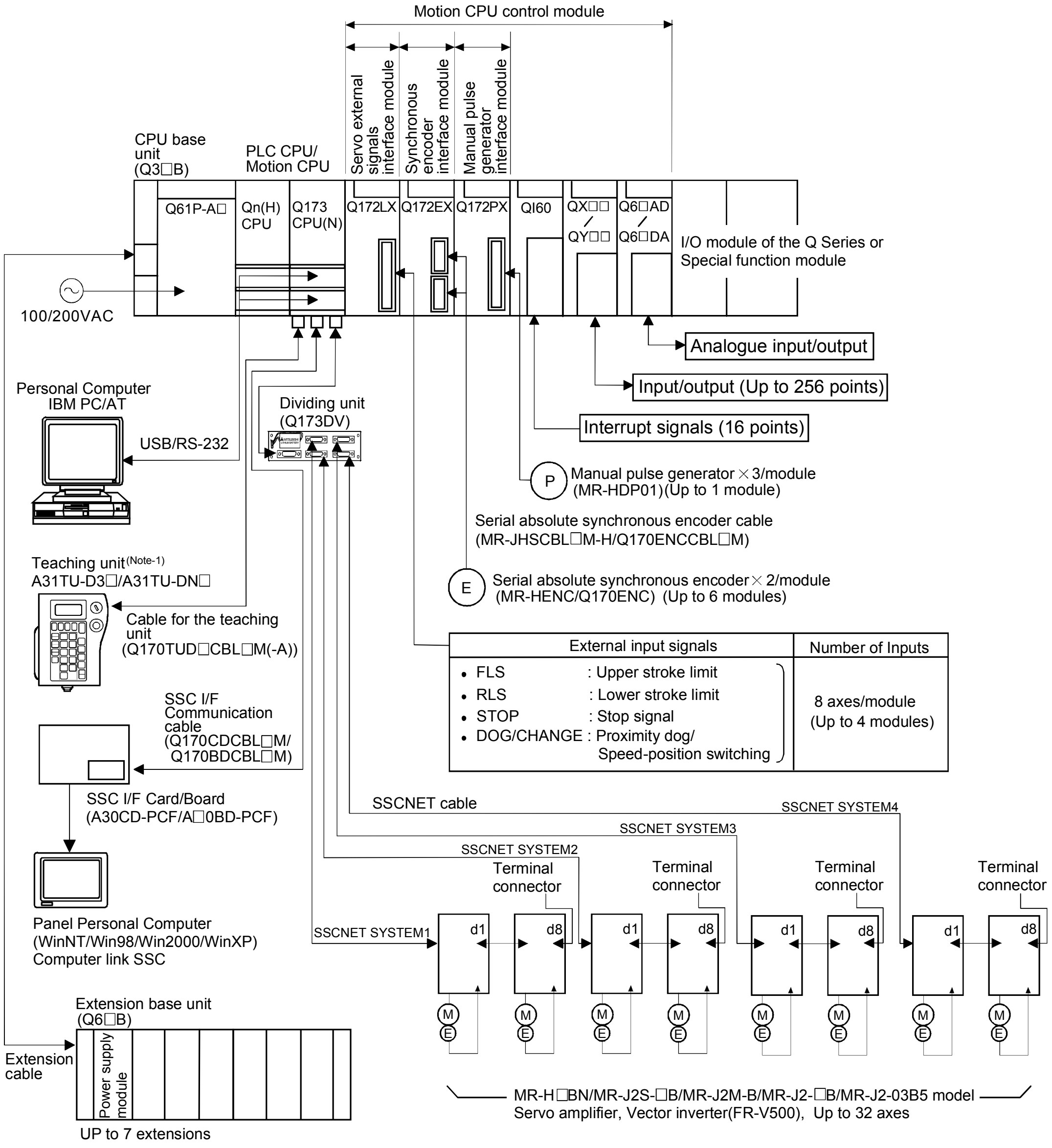
(3) Peripheral device configuration for the Q173CPU(N)/Q172CPU(N)

The following (a)(b)(c) can be used.


(a) RS-232 configuration
(b) USB configuration
(c) SSCNET configuration
Motion CPU module (Q173CPU(N), Q172CPU(N))
Motion CPU module (Q173CPU(N), Q172CPU(N))
Motion CPU module (Q173CPU(N), Q172CPU(N))
RS-232 cable (QC30R2)
USB cable
SSC I/F communication cable (Q170CDCBL□M, Q170BDCBL□M)
Personal computer
Personal computer (Windows® 98/2000/XP only)
MITSUBISHI
SSCNET CARD
A30CD-PCF
SSC I/F Card/Board (A30CD-PCF/A□0BD-PCF)
Personal computer

(Note) : For information about GPP functions of PLC CPU, refer to the operating manual of PLC. Also, refer to the help of each software for information about operation of each programming software package.

1.3.2 Q173CPU(N) System overall configuration


Motion CPU control module
Servo external signals interface module
Synchronous encoder interface module
Manual pulse generator interface module
CPU base unit (Q3□B)
PLC CPU/ Motion CPU
Q61P-A□
Qn(H) CPU
Q173 CPU(N)
Q172LX
Q172EX
Q172PX
QI60
QX□□ / QY□□
Q6□AD / Q6□DA
I/O module of the Q Series or Special function module
100/200VAC
Analogue input/output
Input/output (Up to 256 points)
Interrupt signals (16 points)
Personal Computer IBM PC/AT
USB/RS-232
Dividing unit (Q173DV)
P
Manual pulse generator × 3/module (MR-HDP01)(Up to 1 module)
Serial absolute synchronous encoder cable (MR-JHSCBL□M-H/Q170ENCCBL□M)
E
Serial absolute synchronous encoder × 2/module (MR-HENC/Q170ENC) (Up to 6 modules)
Teaching unit(Note-1) A31TU-D3□/A31TU-DN□
Cable for the teaching unit (Q170TUD□CBL□M(-A))
SSC I/F Communication cable (Q170CDCBL□M/ Q170BDCBL□M)
SSC I/F Card/Board (A30CD-PCF/A□0BD-PCF)
Panel Personal Computer (WinNT/Win98/Win2000/WinXP) Computer link SSC
SSCNET cable
SSCNET SYSTEM1
SSCNET SYSTEM2
SSCNET SYSTEM3
SSCNET SYSTEM4
Terminal connector
Terminal connector
Terminal connector
Terminal connector
d1
d8
d1
d8
d1
d8
d1
d8
M
E
Extension base unit (Q6□B)
Extension cable
Power supply module
UP to 7 extensions
MR-H□BN/MR-J2S-□B/MR-J2M-B/MR-J2-□B/MR-J2-03B5 model Servo amplifier, Vector inverter(FR-V500), Up to 32 axes

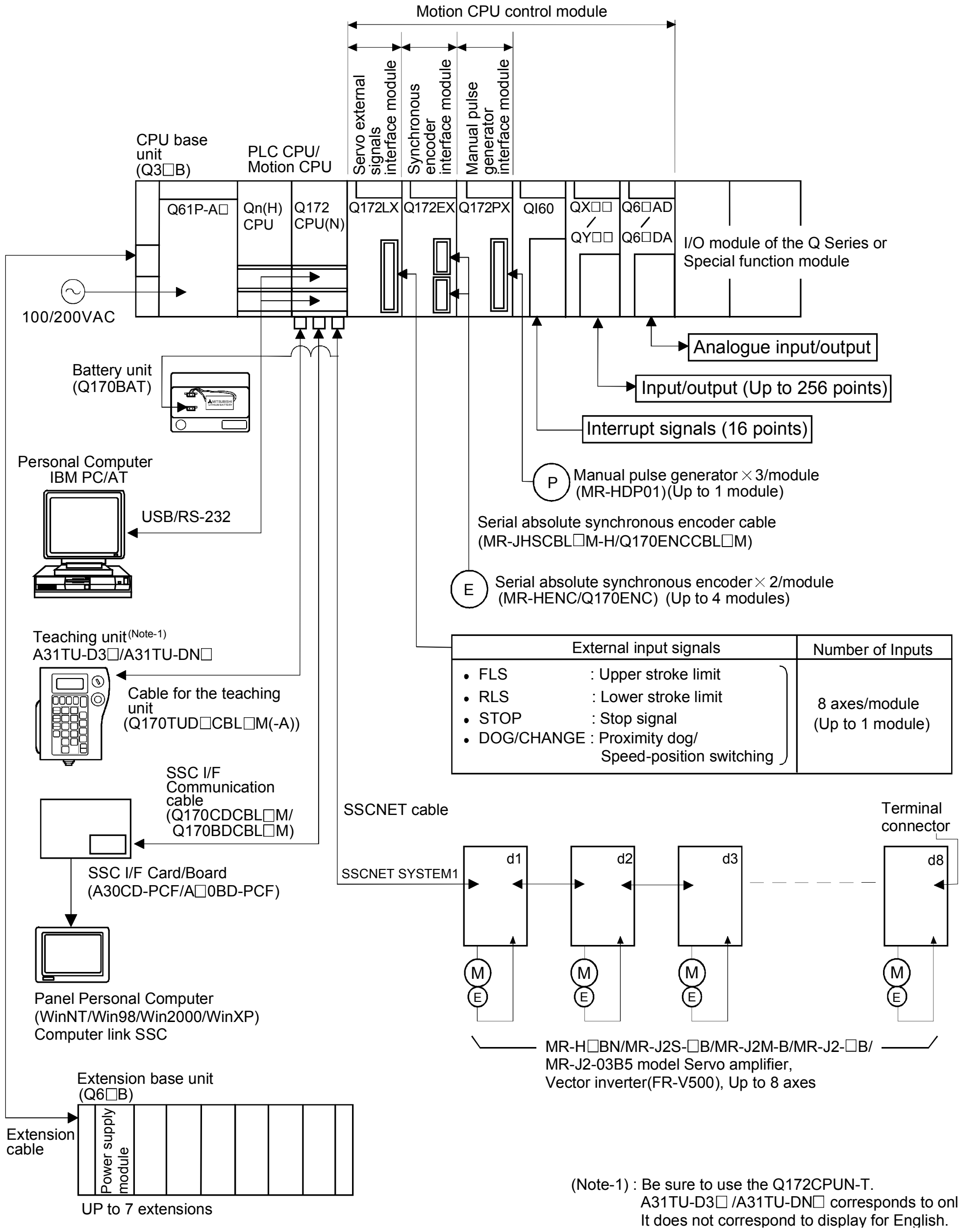
External input signals	Number of Inputs
• FLS : Upper stroke limit • RLS : Lower stroke limit • STOP : Stop signal • DOG/CHANGE : Proximity dog/ Speed-position switching	8 axes/module (Up to 4 modules)

(Note-1) : Be sure to use the Q173CPUN-T.
A31TU-D3□ /A31TU-DN□ corresponds to only Japanese.
It does not correspond to display for English.

⚠CAUTION

- Construct a safety circuit externally of the Motion controller or servo amplifier if the abnormal operation of the Motion controller or servo amplifier differ from the safety directive operation in the system.
- The ratings and characteristics of the parts (other than Motion controller, servo amplifier and servomotor) used in a system must be compatible with the Motion controller, servo amplifier and servomotor.
- Set the parameter values to those that are compatible with the Motion controller, servo amplifier, servomotor and regenerative resistor model and the system application. The protective functions may not function if the settings are incorrect.
- When a teaching unit is used, the cable for the teaching unit is necessary between the Motion CPU (Q173CPUN-T/Q172CPUN-T) and teaching unit. And, connect the short-circuit connector for teaching unit, after removing the teaching unit or when not using it.

1.3.3 Q172CPU(N) System overall configuration


Motion CPU control module
Servo external signals interface module
Synchronous encoder interface module
Manual pulse generator interface module
CPU base unit (Q3□B)
PLC CPU/ Motion CPU
Q61P-A□
Qn(H) CPU
Q172 CPU(N)
Q172LX
Q172EX
Q172PX
QI60
QX□□ / QY□□
Q6□AD / Q6□DA
I/O module of the Q Series or Special function module
100/200VAC
Analogue input/output
Input/output (Up to 256 points)
Interrupt signals (16 points)
Battery unit (Q170BAT)
P
Manual pulse generator × 3/module (MR-HDP01)(Up to 1 module)
Personal Computer IBM PC/AT
USB/RS-232
Serial absolute synchronous encoder cable (MR-JHSCBL□M-H/Q170ENCCBL□M)
E
Serial absolute synchronous encoder × 2/module (MR-HENC/Q170ENC) (Up to 4 modules)
Teaching unit(Note-1) A31TU-D3□/A31TU-DN□
Cable for the teaching unit (Q170TUD□CBL□M(-A))
SSC I/F Communication cable (Q170CDCBL□M/ Q170BDCBL□M)
SSC I/F Card/Board (A30CD-PCF/A□0BD-PCF)
SSCNET cable
SSCNET SYSTEM1
Terminal connector
d1
d2
d3
d8
M
E
Panel Personal Computer (WinNT/Win98/Win2000/WinXP) Computer link SSC
MR-H□BN/MR-J2S-□B/MR-J2M-B/MR-J2-□B/ MR-J2-03B5 model Servo amplifier, Vector inverter(FR-V500), Up to 8 axes
Extension base unit (Q6□B)
Extension cable
Power supply module
UP to 7 extensions

External input signals	Number of Inputs
• FLS : Upper stroke limit • RLS : Lower stroke limit • STOP : Stop signal • DOG/CHANGE : Proximity dog/ Speed-position switching	8 axes/module (Up to 1 module)

(Note-1) : Be sure to use the Q172CPUN-T.
A31TU-D3□ /A31TU-DN□ corresponds to only Japanese.
It does not correspond to display for English.

⚠CAUTION

- Construct a safety circuit externally of the Motion controller or servo amplifier if the abnormal operation of the Motion controller or servo amplifier differ from the safety directive operation in the system.
- The ratings and characteristics of the parts (other than Motion controller, servo amplifier and servomotor) used in a system must be compatible with the Motion controller, servo amplifier and servomotor.
- Set the parameter values to those that are compatible with the Motion controller, servo amplifier, servomotor and regenerative resistor model and the system application. The protective functions may not function if the settings are incorrect.
- When a teaching unit is used, the cable for the teaching unit is necessary between the Motion CPU (Q173CPUN-T/Q172CPUN-T) and teaching unit. And, connect the short-circuit connector for teaching unit, after removing the teaching unit or when not using it.

1.3.4 Software packages

(1) Software packages

(a) Operating system software packages

Application	Software package	
	Q173CPU(N)	Q172CPU(N)
For conveyor assembly **SV13** (Motion SFC)	SW6RN-SV13QB	SW6RN-SV13QD
For automatic machinery **SV22** (Motion SFC)	SW6RN-SV22QA	SW6RN-SV22QC

(b) Integrated start-up support software package

Part name	Model name	Details		
MT Developer	SW6RNC-GSVPROE	SW6RNC-GSVE (Integrated start-up support software (1 CD-ROM))	Conveyor assembly software	: SW6RN-GSV13P
			Automatic machinery software	: SW6RN-GSV22P
			Machine tool peripheral software	: SW6RN-GSV43P
			Cam data creation software	: SW3RN-CAMP
			Digital oscilloscope software	: SW6RN-DOSCP
			Communication system software	: SW6RN-SNETP
			Document print software	: SW3RN-DOCPRNP, SW20RN-DOCPRNP
		SW6RNC-GSVHELPE (Operation manual (1 CD-ROM))		
		Installation manual		
	SW6RNC-GSVSETE	SW6RNC-GSVPROE		
		A30CD-PCF(SSC I/F card (PCMCIA TYPE II 1CH/card))		
		Q170CDCBL3M (A30CD-PCF cable 3m (9.84ft.))		

(Note) : Operating environment of the MT Developer is WindowsNT® 4.0/Windows® 98/Windows® 2000/Windows® XP English version only.

(2) Operating environment of the personal computer

Operating environment is as follows.

IBM PC/AT with which WindowsNT® /Windows® 98/Windows® 2000/Windows® XP English version operates normally.

Item	WindowsNT® 4.0 (Service Pack 2 or later) (Note) or Windows® 98	Windows® 2000	Windows® XP
CPU	Pentium133MHz or more	Pentium II 233MHz or more	Pentium II 450MHz or more
Memory capacity	Recommended 32MB or more	Recommended 64MB or more	Recommended 192MB or more
Hard disk free space	Hard disk free space is as following list.		
Disk drive	3.5inch (1.44MB) floppy disk drive, CD-ROM disk drive		
Display	800×600 pixels, 256 colors or more		

(Note) : Impossible to use USB connection.

It is necessary the following capacity depending on the installed software.

Model name	Size		
	SW6RNC-GSVE		SW6RNC-GSVHELPE
SW6RN-GSV13P	65MB		40MB
SW6RN-GSV22P	66MB		45MB
SW6RN-GSV43P	55MB		32MB
SW3RN-CAMP	5MB		3MB
SW6RN-DOSCP	35MB		10MB
SW6RN-SNETP	Standard	60MB	3MB
	Custom (When all selection)	60.5MB	
SW3RN-DOCPRNP	45MB		5MB
SW20RN-DOCPRNP	45MB		5MB

(Note-1) : WindowsNT® , Windows® are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.

(Note-2) : Pentium ® are trademarks or registered trademarks of Intel Corporation or its subsidiaries in the United States and other countries.

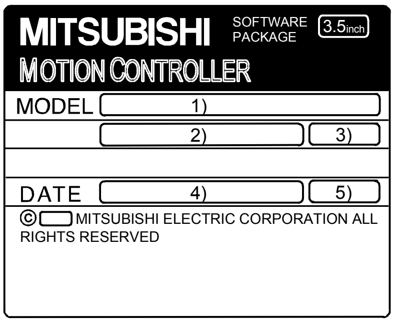
POINT

(1) When the operation of Windows is not unclear in the operation of this software, refer to the manual of Windows or guide-book from the other supplier.

(2) The screen might not be correctly displayed depending on the system font size of WindowsNT® 4.0/Windows® 98/Windows® 2000/Windows® XP.
Be sure to use the small size fonts.

(3) Operating system(OS) type/version

(a) Confirmation method in the operating system(OS)



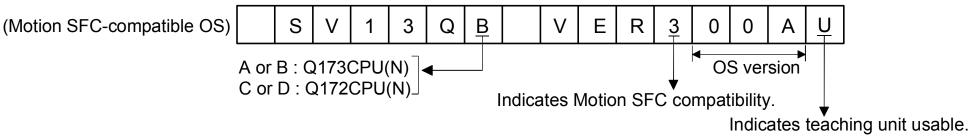
1) OS software TYPE
2) Software version
3) OS software version
4) Serial number
5) Number of FD

Example) When using the Q173CPU(N), SV13 and version A.

1) SW6RN-SV13QB
2) BCD-B14W276
3) A

(b) Confirmation method in the SW6RN-GSV□P

The operating system(OS) type/version of the connected CPU is displayed on the installation screen of the SW6RN-GSV□P.


(Motion SFC-compatible OS)

	S	V	1	3	Q	B		V	E	R	3	0	0	A	U

A or B : Q173CPU(N)
C or D : Q172CPU(N)

OS version

Indicates Motion SFC compatibility.

Indicates teaching unit usable.

(4) Restrictions of the function and PLC CPU by the Motion CPU and software version

The function and PLC CPU which can be used has restrictions by version of the Motion CPU module, operating system software and programming software.
The combination of each version and a function is shown below.

Function		Operating system software version (Note-1)	Programming software version	CPU module version (Note-2)				Section of reference
				Q173 CPU	Q173 CPUN	Q172 CPU	Q172 CPUN	
ROM operation		H	C	M	—	N	—	Chapter 14
ROM operation (For additional parameter (Home position return parameter, etc.))		N	C	T	M	U	M	—
Online change		J	F	—	—	—	—	Section 12.3
Auto refresh function improvement of the CPU shared memory		H	C	M	—	N	—	Section 3.1 (3)
Communications via network		H	C	M	—	N	—	Chapter 16
Main operation cycle monitor		D	—	—	—	—	—	Chapter 17
Read the servo parameter from the servo amplifier.		D	—	—	—	—	—	Chapter 18
Motion SFC instruction	MULTR	D	—	—	—	—	—	Section 7.13.7
	MULTW	D	—	J	—	K	—	Section 7.13.6
	OUT	D	—	—	—	—	—	Section 7.9.5
	TO	H	C	—	—	—	—	Section 7.13.8
	FROM	H	C	—	—	—	—	Section 7.13.9
	FMOV	R	K	—	—	—	—	Section 7.13.5
Motion dedicated instruction (SVST instruction and etc.)		H	—	M	—	N	—	Section 5.3 to 5.6
Vector inverter connectable		K	F	—	—	—	—	—
Basic model QCPU (Function version "B") (Q00CPU, Q01CPU)		M	—	—	—	—	—	—
Home position return functions added		L	F	—	—	—	—	—
Security function		R	K	—	—	—	—	Chapter 15
MR-J2S-B Servo parameter "No.41 and later" setting in the Motion controller		R	K	—	—	—	—	—
Operation setting for incompletion of home position return		R	K	—	—	—	—	Section 6.22.1 (Note-3)
Bit device setting by Motion SFC instruction (BMOV, FMOV, MULTW, MULTR, TO, FROM)		S	K	—	—	—	—	Section 7.13.4 to 7.13.9
Mixed function of virtual mode with real mode (SV22)		R	K	—	—	—	—	Section 10.1 (Note-4)
Cam/ball screw switching function (SV22)		R	K	—	—	—	—	Section 10.2 (Note-4)
Clutch for slippage system (linear acceleration/ deceleration system) for mechanical system program (SV22)		R	K	—	—	—	—	Section 7.2 (Note-4)
Q170ENC (SV22)		R	K	—	—	—	—	—

— : There is no restriction by the version.

(Note-1) : SV13/SV22 is the completely same version.

(Note-2) : Q173CPUN-T/Q172CPUN-T corresponds from the version A.

(Note-3) : Q173CPU(N)/Q172CPU(N) Motion controller (SV13/SV22) Programming Manual (REAL MODE).

(Note-4) : Q173CPU(N)/Q172CPU(N) Motion controller (SV22) Programming Manual (VIRTUAL MODE).

(5) Relevant software packages

(a) PLC software package

Model name	Software package
GX Developer	SW□D5C-GPPW-E

(Note) : □=used "6" or later.

1.3.5 Restrictions on motion systems

(1) It is not allowed to use the Motion CPU as the control CPU of a module installed on the QA1S6□B extension base unit. PLC CPU must be used as the control CPU.

(2) The connector for installation of memory card on the Motion CPU module is for future function expansion.

(3) Motion CPU module cannot be used as standalone module. It must always be used in combination with the PLC CPU module (version that supports Multiple CPU systems). Moreover, it must be installed on the right side of PLC CPU module. PLC CPU module cannot be installed in a position to the right of Motion CPU module.

(4) Personal computer CPU unit must be installed on the right side of Motion CPU module. Motion CPU module cannot be installed in a position to the right of personal computer CPU unit.

(5) Make sure to use the PLC CPU module in the "Q mode".

(6) Motion CPU module cannot be set as the control CPU of intelligent function module or Graphic Operation Terminal (GOT).

(7) SSCNET cable which connects the Motion CPU and servo amplifier, and the teaching unit connecting cable which connects the Motion CPU and A31TU-D3□/ A31TU-DN□ (Note-1) are pulled from the bottom part of unit. Make sure to secure sufficient space for pulling out the cable when designing the control panel.

(8) Motion CPU module is one module element of Q series Multiple CPU system. It must be set the parameters of Q series Multiple CPU system for each PLC CPU. Motion CPU module must also be set to support the Multiple CPU system in the system settings.

(9) Make sure to use the Motion CPU as the control CPU of motion modules dedicated for Motion CPU (e.g., Q172LX, Q172EX(Note-2), Q173PX). They will not operate correctly if PLC CPU is set and installed as the control CPU by mistake. Motion CPU is treated as a 32-point intelligent module by PLC CPU of other CPU. It cannot be accessed from other CPU.

(10) When a Multiple CPU system is configured, make sure to configure the modules so that the total current consumption of individual modules on the CPU base does not exceed the 5 VDC output capacity of power supply module.

(11) Motion modules (Q172LX, Q172EX, Q173PX) is to do selection whether to be necessary referring to the "3. DESIGN" of the "Q173CPU(N)/Q172CPU(N) User's Manual" for the system design.

(12) Installation position of the Q172EX-S2/S3(Note-2) is only CPU base unit.

(Note-1) : Teaching unit can be used in SV13. It cannot be used in SV22.
(Note-2) : Q172EX can be used in SV22. It cannot be used in SV13.

1.4 Multiple CPU System

1.4.1 Overview

(1) Multiple CPU System

Multiple (up to 4 modules) PLC CPUs and Motion CPUs are installed to the CPU base unit, and each CPU controls the I/O modules and intelligent function modules of the CPU base unit/extension base unit slot by slot in the Multiple CPU system.
Each Motion CPU controls the servo amplifiers connected by SSCNET cable.

(2) Distributed system configuration

(a) By distributing such tasks as servo control, machine control and information control among multiple processors, the flexible system configuration can be realized.

(b) You can increase the number of control axes by using a multiple Motion CPUs. It is possible to control up to 96 axes by using three Q173CPU(N)s.

(c) You can reduce the PLC scan time of the overall system by using a multiple PLC CPUs and distributing the PLC control load among them.

(3) Communication among the CPUs in the Multiple CPU system

(a) Transmission of data among the CPUs in the Multiple CPU system is performed automatically using the multiple CPU automatic refresh function. This makes it possible to use the device data of the other CPUs as the device data of the self CPU.

(b) You can access the device data and start the Motion SFC program from the PLC CPU to the Motion CPU by Motion dedicated PLC instruction.

1.4.2 Installation of PLC CPU and Motion CPU

Up to a total four PLC CPUs and Motion CPUs can be installed in the CPU base unit, in the four slots starting from the CPU slot (the slot located to the immediate right of the power supply module) to slot 2 in series.
There must be no non-installation slot left, between a PLC CPU and a Motion CPU, or between Motion CPUs.
When two or more Motion CPUs are installed, they are installed together in the slots provided to the right of one or more PLC CPUs. (PLC CPU cannot be installed to the right of a Motion CPU.)

(1) When the high performance model PLC CPU is used.

Number of CPUs	Installation positions of PLC CPUs/Motion CPUs				
		CPU	0	1	2
2	Power supply	PLC CPU	Motion CPU	I/O, etc.	I/O, etc.
3	Power supply	PLC CPU	PLC CPU	Motion CPU	I/O, etc.
	Power supply	PLC CPU	Motion CPU	Motion CPU	I/O, etc.
4	Power supply	PLC CPU	PLC CPU	PLC CPU	Motion CPU
	Power supply	PLC CPU	PLC CPU	Motion CPU	Motion CPU
	Power supply	PLC CPU	Motion CPU	Motion CPU	Motion CPU

(2) When the basic model PLC CPU is used.

Multiple CPU system up to 3 modules (PLC CPU × 1, Motion CPU × 1, Personal computer CPU × 1).

1.4.3 Precautions for using Q series I/O modules and intelligent function modules

(1) Modules controllable by the Motion CPU

I/O modules (QX□, QX□-S1, QY□, QH□, QX□Y□, Q6□AD□, Q6□AD-□, Q6□DA□, Q6□DA-□), interrupt module (QI60) and motion modules (Q172LX, Q172EX, Q173PX) can be controlled by the Motion CPU.

(2) Compatibility with the Multiple CPU system

(a) All I/O modules (QX□, QX□-S1, QY□, QH□, QX□Y□, Q6□AD□, Q6□AD-□, Q6□DA□, Q6□DA-□) support the Multiple CPU system.

(b) The interrupt module (QI60), which is currently not subject to function upgrade, supports the Multiple CPU system.

(c) The intelligent function modules support the Multiple CPU system only when their function version is B or later. These modules cannot be controlled by the Motion CPU, so be sure to use the PLC CPU as a control CPU.

(d) All motion modules (Q172LX, Q172EX, Q173PX) support the Multiple CPU system. These modules cannot be controlled by the PLC CPU, so be sure to use the Motion CPU as a control CPU.

(3) Access range from a non-control CPU

(a) The Motion CPU can access only the modules controlled by the self CPU. It cannot access the modules controlled by other CPUs.

(b) Access range from a non-control CPU for the modules controlled by the Motion CPU are shown below.

Access target		I/O setting from outside the group (setting from the PLC CPU)	
		Not received	Received
Input (X)		×	○
Output (Y)		×	×
Buffer memory	Read	×	×
	Write	×	×

REMARK

- The function version of an intelligent function module can be checked on the rated plate of the intelligent function module or in the GX Developer's system monitor product information list.
- Refer to the "Q173CPU(N)/Q172CPU(N) User's Manual" for the model name which can be controlled by the Motion CPU.

1.4.4 Modules subject to installation restrictions

(1) Modules subject to installation restrictions in the Motion CPU are sown below. Use within the restrictions listed below.

Description	Model name	Maximum installable modules per CPU	
		Q173CPU(N)	Q172CPU(N)
Servo external signals interface module	Q172LX	4 modules	1 module
Serial absolute synchronous interface module	Q172EX (Note-1)	6 modules	4 modules
Manual pulse generator interface module	Q173PX (Note-2)	4 modules (Note-1) (When using the incremental serial encoder.)	3 modules (Note-1) (When using the incremental serial encoder.)
		1 module (When using only the Manual pulse generator.)	1 module (When using only the Manual pulse generator.)
Input module	QX□ QX□-S1	Total 256 points	
Output module	QY□		
Input/output composite module	QH□ QX□Y□		
Analogue input module (Note-3)	Q6□AD□ Q6□AD-□		
Analogue output module (Note-3)	Q6□DA□ Q6□DA-□		
Interrupt module	QI60	1 module	

(Note-1) : SV22 only.

(Note-2) : When the Manual pulse generator and the serial encoder are used at the same time with the SV22, the Q173PX installed in the slot of the smallest number is used for manual pulse generator input.

(Note-3) : A maximum of 4 modules, analogue input modules and analogue output modules, can be used.

(2) Modules controlled by a Motion CPU cannot be installed in the extension base unit QA1S6□B. Install them in the CPU base unit Q3□B or extension base unit Q6□B.

(3) A total of eight base units including one CPU base unit and seven extension base units can be used. However, the usable slots (number of modules) are limited to 64 per system including vacant slots. If a module is installed in slot 65 or subsequent slot, an error (SP. UNIT LAY ERROR) will occur. Make sure all modules are installed in slots 1 to 64. (Even when the total number of slots provided by the CPU base unit and extension base units exceeds 65 (such as when six 12-slot base units are used), an error does not occur as long as the modules are installed within slots 1 to 64.)

1.4.5 Processing time of the Multiple CPU system

(1) Processing of the Multiple CPU system

Each CPU module of the Multiple CPU system accesses to the modules controlled by self CPU with which the CPU base unit or extension base unit is installed, and the other CPU through the bus (base unit patterns and extension cables). However, a multiple CPU module cannot use the bus simultaneously. When a multiple CPUs have accessed the bus simultaneously, the CPUs which performed buss access later remain in "waiting state" until the CPU currently using the bus completes its processing. In a Multiple CPU system, the above waiting time (duration while a CPU remains in waiting state) causes an I/O delay or prolonged scan time.

(2) When the waiting time becomes the longest

In the Multiple CPU system, the wait time of self CPU becomes the longest in the following conditions:

- When is using a total of four PLC CPUs/Motion CPUs are used in the Multiple CPU system.
- When the extension base units are used.
- When the intelligent function modules handling large volumes of data are installed in the extension base unit(s).
- When a total of four CPUs are used and the four CPUs have simultaneously accessed a module installed in an extension base unit.
- When there are many automatic refresh points between a PLC CPU and a Motion CPU.

(3) When shortening the processing time of the Multiple CPU system

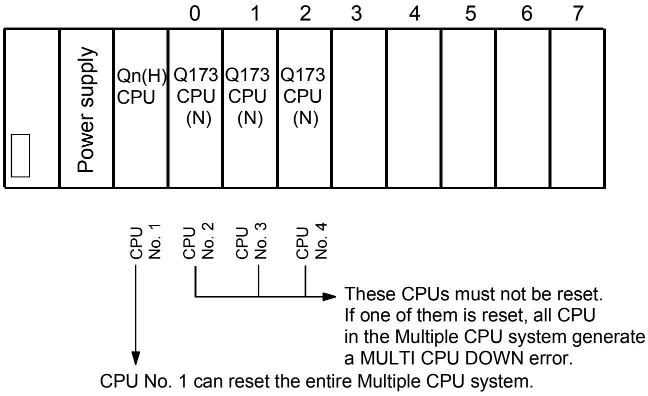
The processing time of the Multiple CPU system can be shortened in the following methods:

- Install all modules with many access points such as MELSECNET/10(H) and CC-Link refreshes together in the CPU base unit.
- Control all modules with many access points such as MELSECNET/10(H) and CC-Link refreshes using only one PLC CPU so that they are not accessed by two or more CPUs simultaneously.
- Reduce the number of refresh points of MELSECNET/10(H), CC-Link, etc.
- Reduce the number of automatic refresh points of the PLC CPUs/Motion CPUs.

1.4.6 How to reset the Multiple CPU system

With the Multiple CPU system, resetting the PLC CPU of CPU No. 1 resets the entire system.
When the PLC CPU of CPU No. 1 is reset, the CPUs, I/O modules and intelligent function modules of all CPUs will be reset.

To recover any of the CPUs in the Multiple CPU system that generated a CPU stop error, reset the PLC CPU of CPU No. 1 or restart the power (i.e., turning the power ON, OFF and then ON).
(If the PLC CPUs or Motion CPUs of CPU Nos. 2 through 4 generated a CPU stop error, they can not be recovered by resetting the corresponding CPU.)


0
1
2
3
4
5
6
7
Power supply
Qn(H) CPU
Q173 CPU (N)
Q173 CPU (N)
Q173 CPU (N)
CPU No. 1
CPU No. 2
CPU No. 3
CPU No. 4
These CPUs must not be reset. If one of them is reset, all CPU in the Multiple CPU system generate a MULTI CPU DOWN error.
CPU No. 1 can reset the entire Multiple CPU system.

POINT

(1) In a Multiple CPU system, the PLC CPUs/Motion CPUs of CPU No. 2, 3 or 4 cannot be reset individually.
When a PLC CPU or Motion CPU of CPU No. 2, 3 or 4 is reset while the Multiple CPU system is operating, the other CPUs generate a MULTI CPU DOWN error (error code: 7000) and the entire system stops.
Note that depending on the timing at which the PLC CPU or Motion CPU of CPU No. 2, 3 or 4 is reset, the PLC CPU of a the other CPU may stop due to an error other than MULTI CPU DOWN.

(2) Resetting CPU No. 2, 3 or 4 generates a MULTI CPU DOWN error regardless of the operation mode set in the Multiple CPU Settings tab. (Stop/continue all CPUs upon error in CPU No. 2, 3 or 4.) (Refer to section 1.4.7 for the setting of operation mode in Multiple CPU Settings.)

1.4.7 Processing at a CPU DOWN error occurrence by a PLC CPU or Q173CPU(N)/ Q172CPU(N)

In the Multiple CPU system, the system operates differently when CPU No. 1 generated a CPU DOWN error as compared with when CPU No. 2, 3 or 4 did.

(1) When CPU No. 1 generated a CPU DOWN error

(a) When the PLC CPU of CPU No. 1 generated a CPU DOWN error, all PLC CPU/Q173CPU(N)/Q172CPU(N) of CPU Nos. 2, 3 and 4 generate a MULTI CPU DOWN error (error code: 7000) and the Multiple CPU system stops. (Note-1)

(b) Recover the system using the procedure below:

1) Check the cause of the error that occurred in CPU No. 1 using the PC diagnostic function of GX Developer.

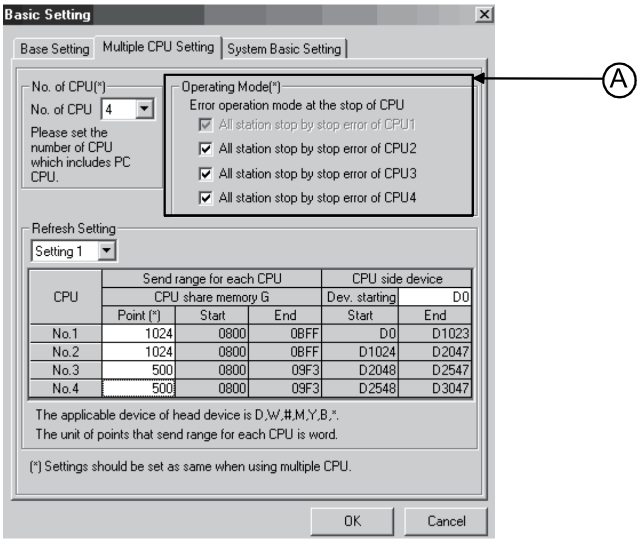
2) Remove the cause of the error.

3) Reset the PLC CPU of CPU No. 1 or restart the power.

Resetting the PLC CPU of CPU No. 1 or restarting the power resets all CPUs in the Multiple CPU system and the system is recovered.

(2) When CPU No. 2, 3 or 4 generated a CPU DOWN error

If the PLC CPU, Q173CPU(N) or Q172CPU(N) of CPU No. 2, 3 or 4 generated a CPU DOWN error, the entire system may or may not stop depending on the setting of "Operation Mode" in the Multiple CPU Settings tab.
By default value, all CPUs will stop when any of the CPUs generates a CPU stop error. If you do not wish to stop all CPUs following an error generated in the PLC CPU, Q173CPU(N) or Q172CPU(N) of a specific CPU or CPUs, click and uncheck the CPU or CPUs that will not stop all CPUs upon generating an error. (See arrow A.)



No. of CPU(*)
No. of CPU 4
Please set the number of CPU which includes PC CPU.

Operating Mode(*)
Error operation mode at the stop of CPU
☑ All station stop by stop error of CPU1
☑ All station stop by stop error of CPU2
☑ All station stop by stop error of CPU3
☑ All station stop by stop error of CPU4

Refresh Setting
Setting 1

CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. starting	D0
	Point (*)	Start	End	Start	End
No.1	1024	0800	0BFF	D0	D1023
No.2	1024	0800	0BFF	D1024	D2047
No.3	500	0800	09F3	D2048	D2547
No.4	500	0800	09F3	D2548	D3047

The applicable device of head device is D,W,#,M,Y,B,*.
The unit of points that send range for each CPU is word.

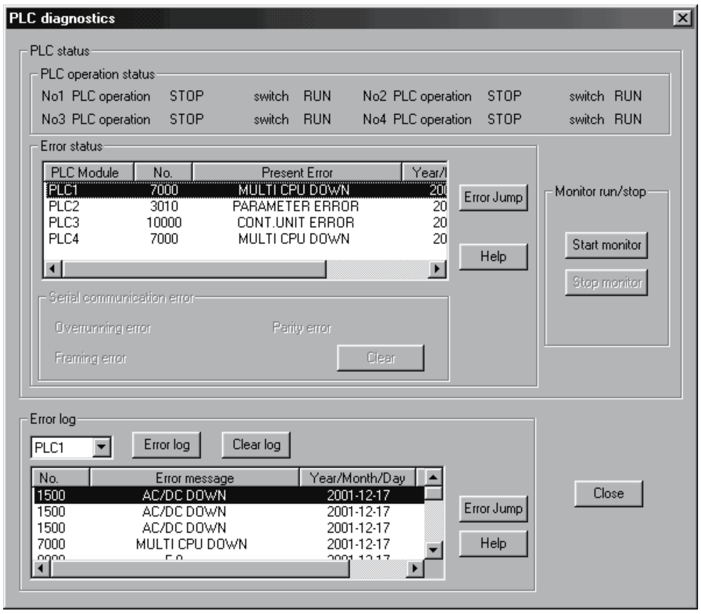
(*) Settings should be set as same when using multiple CPU.

(a) When a CPU DOWN error occurs in the CPU of the CPU in a checked "Stop all CPUs upon error in CPU No. n" item, all PLC CPU/Q173CPU(N)/Q172CPU(N) of the other CPUs will generate a MULTI CPU DOWN error (error code: 7000) and the Multiple CPU system will stop. (Note-1)

(b) When a CPU DOWN error occurs in the CPU of the PLC in an unchecked "Stop all CPUs upon error in CPU No. n" item, all CPUs of the other CPUs will generate a MULTI CPU ERROR (error code: 7020) and continue their operation.

POINT

(Note-1) : When a CPU DOWN error occurs, the CPU detecting the error will generate a MULTI CPU DOWN error.
Therefore, the system may enter a MULTI CPU DOWN mode after detecting the CPU DOWN error in the CPU generating a MULTI CPU DOWN error, instead of the error in the CPU that generated the CPU DOWN error in the first place. In this case, the common error-data area may store a CPU number different from one corresponding to the CPU that generated the CPU DOWN error first.
When recovering the system, remove the cause of the error present in the CPU not stopped by a MULTI CPU DOWN error.
In the screen below, the cause of the error present in CPU No. 2, which does not have a MULTI CPU DOWN error, should be removed.



PLC diagnostics

PLC status

PLC operation status

No1 PLC operation STOP switch RUN No2 PLC operation STOP switch RUN
No3 PLC operation STOP switch RUN No4 PLC operation STOP switch RUN

Error status

PLC Module	No.	Present Error	Year/
PLC1	7000	MULTI CPU DOWN	20
PLC2	3010	PARAMETER ERROR	20
PLC3	10000	CONT.UNIT ERROR	20
PLC4	7000	MULTI CPU DOWN	20

Error log

PLC1

No.	Error message	Year/Month/Day
1500	AC/DC DOWN	2001-12-17
1500	AC/DC DOWN	2001-12-17
1500	AC/DC DOWN	2001-12-17
7000	MULTI CPU DOWN	2001-12-17

(c) Use the following procedure to recover the system:

1) Check the CPU generating the error and cause of the error using the PC diagnostic function of GX Developer.
2) If the error occurred in a Q173CPU(N)/Q172CPU(N) and the error code is 10000, check the cause of the error using error list of SW6RN-GSV□P.
3) Remove the cause of the error.
4) Reset the PLC CPU of CPU No. 1 or restart the power.
5) Resetting the PLC CPU of CPU No. 1 or restarting the power resets all CPUs in the Multiple CPU system and the system will be recovered.

(3) Operation at a Motion CPU error

Operations at a Motion CPU error are shown below.

Category	Type of error	Operation	Remark
Operation disable errors	System setting error	Does not operate from the beginning (does not run).	• All actual output PY points turn OFF. No effect on other CPUs.
	WDT error	Varies depending on the error.	• All actual output PY points turn OFF. Other CPUs may also stop depending on the parameter setting.
	Self-diagnosis error	Stops at a CPU DOWN error.	
	Other CPU DOWN error	Operation corresponding to STOP (M2000 OFF). Depends on the "Operation mode upon CPU stop error" setting.	• All actual output PY points turn OFF.
Operation continuous enable errors	Self-diagnosis error	Operation continues when the continuous error occurred.	
	Motion SFC error	Processing stops for each program or axis instead of the Motion CPU stopping all the processing.	• Only the applicable program stops (the program may continue depending on the type of error). • Actual output PY retains output. • No effect on other CPUs.
	Minor error		
	Major error		
	Servo error		
	Servo program setting error		

1.5 System Settings

1.5.1 System data settings

The table below lists the system data items to be set.

	Item		Setting range	Initial value	Remark
Common system parameters	Base setting	CPU base	2/3/5/8/10/12 slots	CPU base : 2 slots	Set the number of slots in the CPU base or extension base.
		Extension base	None/2/3/5/8/10/12 slots	None	
	Multiple CPU setting	Number of Multiple CPUs	2/3/4 modules	2 modules	Set the total number of Multiple CPUs including PLC CPU(s).
		Automatic refresh setting	Up to 2k words of devices (D/W/#/M/Y/B) can be set per CPU for settings 1 to 4.	None	Set the automatic refresh between CPUs using Multiple CPU shared memory.
		Error operation mode at the stop of CPU	Stop/do not stop all CPUs upon an error in CPU Nos. 1/2/3/4. (The setting range varies depending on the number of Multiple CPUs installed.)	Stop all CPUs upon error in CPU Nos. 1/2/3/4	Set whether or not to stop the entire system when a CPU stop error occurs in each CPU.
	Motion slot setting	Module arrangement	Within the CPU base and extension base slots	None	Install the modules controlled by the self CPU in the CPU base and/or extension base(s).
		Individual module	Varies depending on the module.	Varies depending on the module.	Set detailed items for each module controlled by the self CPU.
Individual parameters	Basic system setting	Operation cycle setting	0.8 ms/1.7 ms/3.5 ms/7.1 ms/14.2ms/Auto	Auto	Set the operation cycle of motion control.
		Operation at STOP to RUN	M2000 is turned on with switch (STOP to RUN). M2000 becomes a switch set (STOP to RUN) + register by single-unit with turning on.	M2000 is turned on with switch (STOP to RUN).	Set the condition in which the PLC ready flag (M2000) turns on.
		Forced stop (Note)	None/X (PX) (0 to 1FFF)/ M (0 to 8191)	None	Set the bit device used for forced stop.
		Latch range	M (0 to 8191)/B (0 to 1FFF)/F (0 to 2047)/D (0 to 8191)/W (0 to 1FFF)	None	Set the latch range of device memory.
	Self CPU installation position setting		Set self CPU/another CPU/CPU (empty) for slots 0/1/2. (The setting range varies depending on the number of Multiple CPUs installed.)	None (When two CPUs are installed, slot 0 is fixed as the self CPU.)	Set the installation position of the self CPU in the CPU base.

	Servo amplifier/motor setting		Q173CPU(N):
			Up to 2 systems, 32 axes
			Q172CPU(N):
			Up to 1 system, 8 axes
				None	Set the model name, axis No. and other details for the servo amplifiers and servomotors.

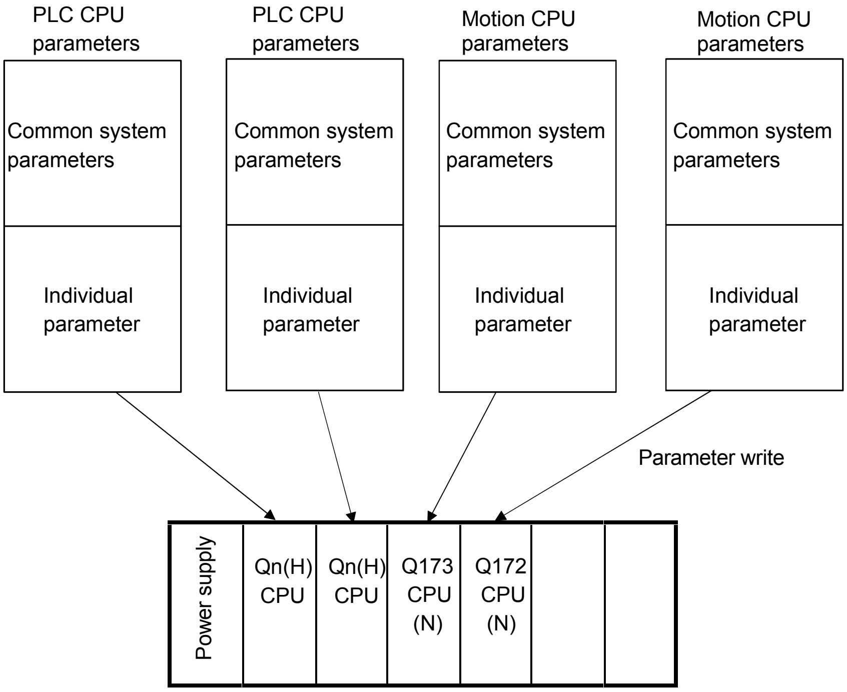
	High-speed read setting		One Q172EX/Q173PX module and one input module.	None	Set the high-speed read data. Refer to "Q173CPU(N)/Q172CPU(N) Motion controller (SV13/SV22) Programming Manual (Real Mode)" for the high-speed read function.
	Battery setting		External battery unused/ External battery used	External battery unused.	Set whether or not to use an external battery. If the power supply is down for one month or longer, data must be backed up with an external battery. Refer to "Q173CPU(N)/Q172CPU(N) User's Manual" for external battery.

(Note) : The forced stop can also be executed by the forced stop terminal of the servo amplifier besides the forced stop input setting.

1.5.2 Common system parameters

(1) Parameters for operating the Multiple CPU system

In the Multiple CPU system, the common system parameters and individual parameter for each CPU are set and written into each CPU. Regarding the Motion CPU, the items in System Settings related to the entire Multiple CPU system must be identical to the parameter settings in the PLC CPU.



(2) Parameters common throughout the Multiple CPU system

In the Motion CPU, during initialization the parameters in the table below are verified against the parameters in the PLC CPU of CPU No. 1. Unmatched parameters generate a PARAMETER ERROR (error code: 3012), so the parameters show below must be set identically between Motion CPUs and the PLC CPU of CPU No. 1. (If the system settings are changed in a Motion CPU, it is necessary to reset. Therefore, the parameters are checked only during initialization.)

PLC CPUs can use the parameters of the other CPUs via "Multiple CPU parameter utilization" in GX Developer. Since Motion CPUs don't have this function, however, the common parameters must be set for each Motion CPU.

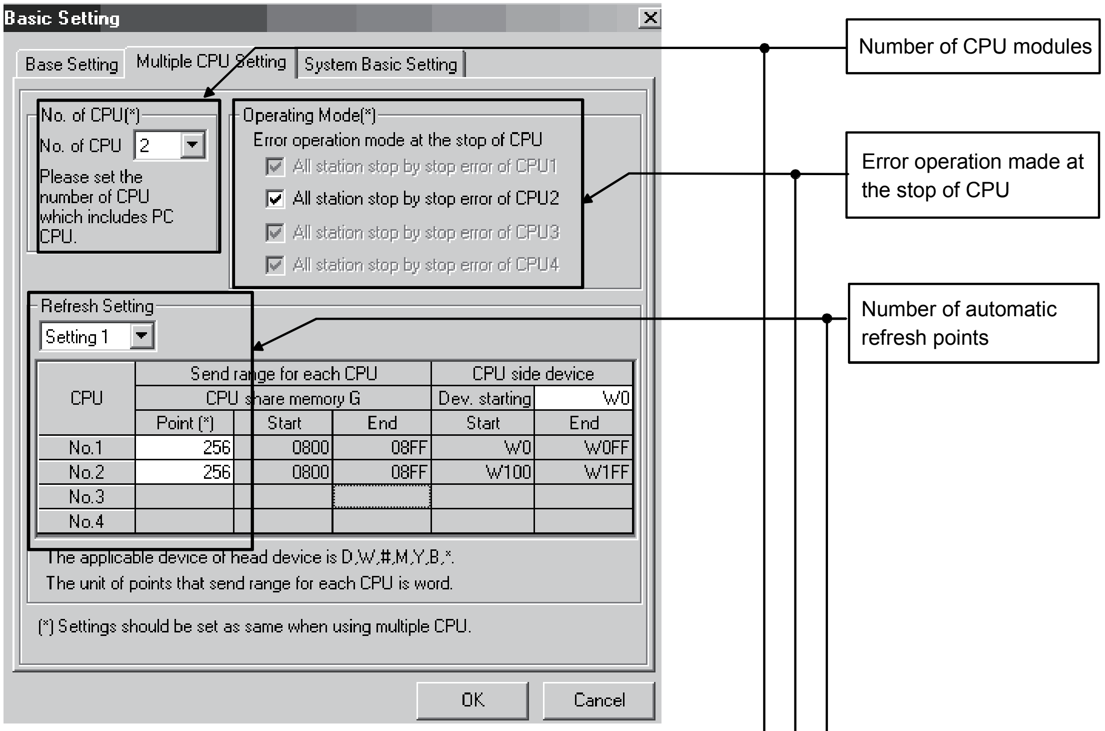
Type of parameter			Verification item		Remark
Name in Motion CPU	Name in PLC CPU				
Multiple CPU settings	Number of Multiple CPUs		Number of CPU modules		
	Operation mode		Operation mode when a CPU stop error occurred		
	Automatic refresh setting		Number of automatic refresh points		
Motion slot settings	I/O assignment	Control CPU	Control CPU No.		• Only the module numbers set in System Settings on the Motion CPU side are verified.
Base settings		Basic settings	Total number of bases		• Not verified if base settings are omitted on the PLC CPU side.
			Base	Base No.	
				Number of base slots	

(a) Multiple CPU settings

Set the following items identically in Multiple CPU Settings (Motion CPU setting) in SW6RN-GSV□P and in Multiple CPU Settings (PLC CPU setting) in GX Developer.

- Number of CPU modules
- Operation mode when a CPU stop error occurred
- Number of automatic refresh points (Settings 1 to 4 must be the same for all CPUs)

• Multiple CPU Settings (Motion CPU setting) in SW6RN-GSV□ P



Basic Setting

No. of CPU(*)

No. of CPU: 2

Please set the number of CPU which includes PC CPU.

Operating Mode(*)

Error operation mode at the stop of CPU

- ☑ All station stop by stop error of CPU1
- ☑ All station stop by stop error of CPU2
- ☑ All station stop by stop error of CPU3
- ☑ All station stop by stop error of CPU4

Refresh Setting

Setting 1

CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. starting	W0
	Point (*)	Start	End	Start	End
No.1	256	0800	08FF	W0	W0FF
No.2	256	0800	08FF	W100	W1FF
No.3					
No.4					

The applicable device of head device is D,W,#,M,Y,B,*.

The unit of points that send range for each CPU is word.

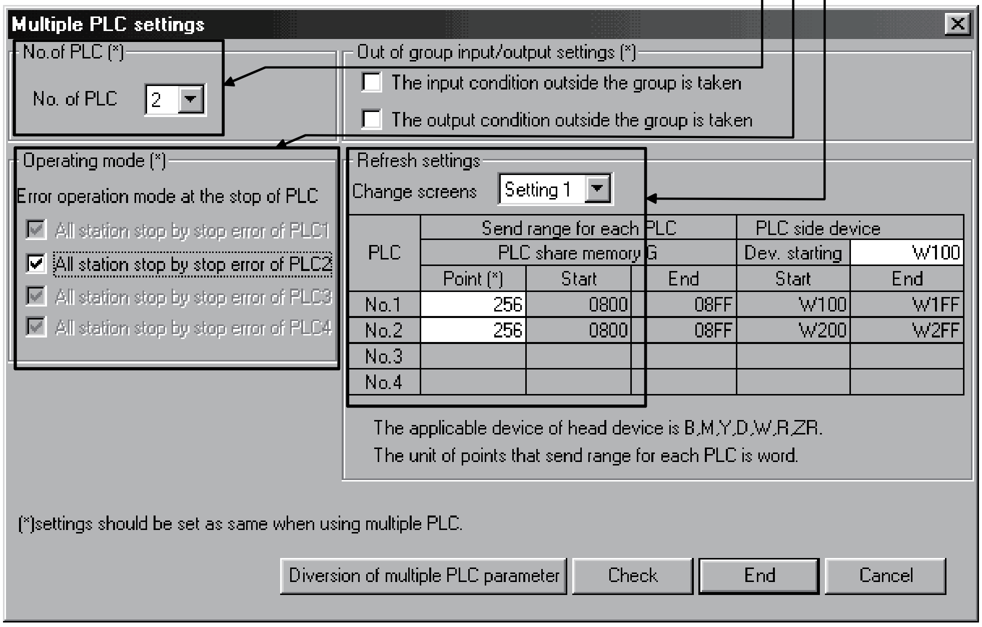
(*) Settings should be set as same when using multiple CPU.

Number of CPU modules

Error operation made at the stop of CPU

Number of automatic refresh points

• Multiple PLC Setting (PLC CPU setting) in GX Developer



Multiple PLC settings

No.of PLC (*)

No. of PLC: 2

Out of group input/output settings (*)

- □ The input condition outside the group is taken
- □ The output condition outside the group is taken

Operating mode (*)

Error operation mode at the stop of PLC

- ☑ All station stop by stop error of PLC1
- ☑ All station stop by stop error of PLC2
- ☑ All station stop by stop error of PLC3
- ☑ All station stop by stop error of PLC4

Refresh settings

Change screens: Setting 1

PLC	Send range for each PLC			PLC side device	
	PLC share memory G			Dev. starting	W100
	Point (*)	Start	End	Start	End
No.1	256	0800	08FF	W100	W1FF
No.2	256	0800	08FF	W200	W2FF
No.3					
No.4					

The applicable device of head device is B,M,Y,D,W,R,ZR.

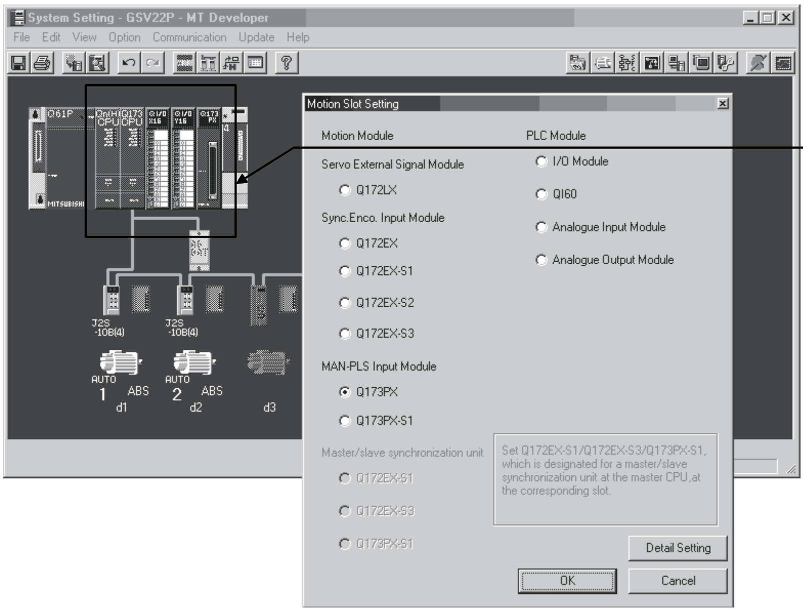
The unit of points that send range for each PLC is word.

(*)settings should be set as same when using multiple PLC.

(b) Motion slot settings

Set the modules controlled by the self CPU by the Motion Slot Settings (Motion CPU setting) in SW6RN-GSV□P. In GX Developer, set the slot for Motion CPU control as the CPU number of the Motion CPU in I/O Assignment Settings (PLC CPU setting).

- Motion Slot Setting (Motion CPU setting) in SW6RN-GSV□P



Motion Slot Setting

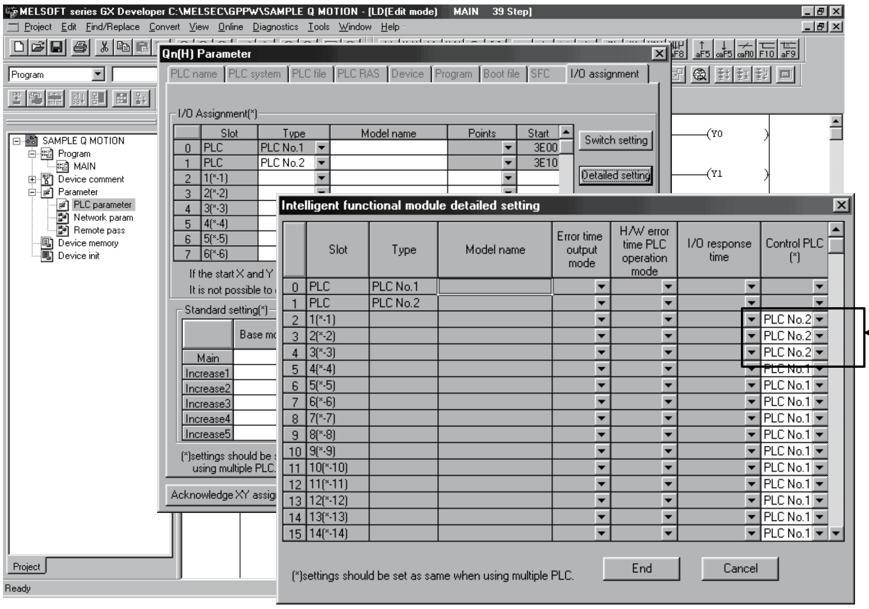
Motion Module
Servo External Signal Module
○ Q172LX
Sync.Enco. Input Module
○ Q172EX
○ Q172EX-S1
○ Q172EX-S2
○ Q172EX-S3
MAN-PLS Input Module
● Q173PX
○ Q173PX-S1
Master/slave synchronization unit
○ Q172EX-S1
○ Q172EX-S3
○ Q173PX-S1

PLC Module
○ I/O Module
○ QI60
○ Analogue Input Module
○ Analogue Output Module

Set Q172EX-S1/Q172EX-S3/Q173PX-S1, which is designated for a master/slave synchronization unit at the master CPU,at the corresponding slot.

Control CPU No.

- I/O Assignment Setting (PLC CPU setting) in GX Developer



I/O Assignment(*)

	Slot	Type	Model name	Points	Start
0	PLC	PLC No.1			3E00
1	PLC	PLC No.2			3E10
2	1(*-1)				
3	2(*-2)				
4	3(*-3)				
5	4(*-4)				
6	5(*-5)				
7	6(*-6)				

If the start X and Y
It is not possible to

(*)settings should be
using multiple PLC.

Intelligent functional module detailed setting

	Slot	Type	Model name	Error time output mode	H/W error time PLC operation mode	I/O response time	Control PLC (*)
0	PLC	PLC No.1					
1	PLC	PLC No.2					
2	1(*-1)						PLC No.2
3	2(*-2)						PLC No.2
4	3(*-3)						PLC No.2
5	4(*-4)						PLC No.1
6	5(*-5)						PLC No.1
7	6(*-6)						PLC No.1
8	7(*-7)						PLC No.1
9	8(*-8)						PLC No.1
10	9(*-9)						PLC No.1
11	10(*-10)						PLC No.1
12	11(*-11)						PLC No.1
13	12(*-12)						PLC No.1
14	13(*-13)						PLC No.1
15	14(*-14)						PLC No.1

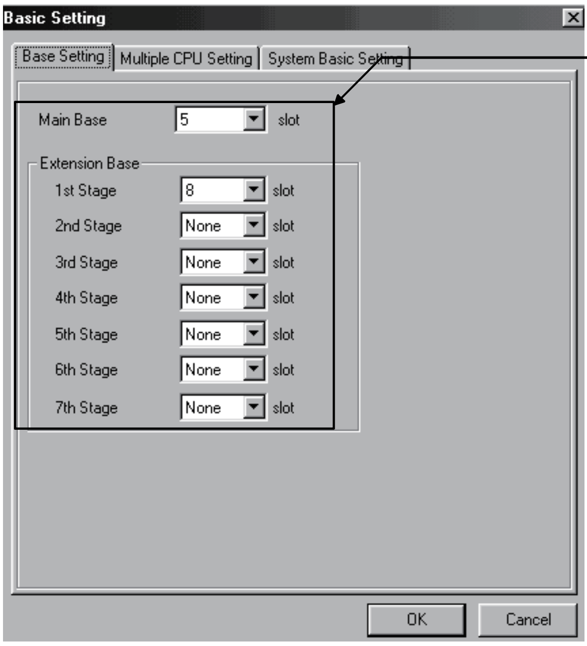
(*)settings should be set as same when using multiple PLC.

(Note): Motion slot setting items are different depending on the operating system software.

(c) Base settings

Set the total number of bases and number of slots in each base identically between Base Settings (Motion CPU setting) in SW6RN-GSV□P and I/O Assignment Settings (PLC CPU setting) in GX Developer. In GX Developer, the detailed settings may be omitted by setting the base mode "Automatic".

- Base Settings (Motion CPU setting) in SW6RN-GSV□P



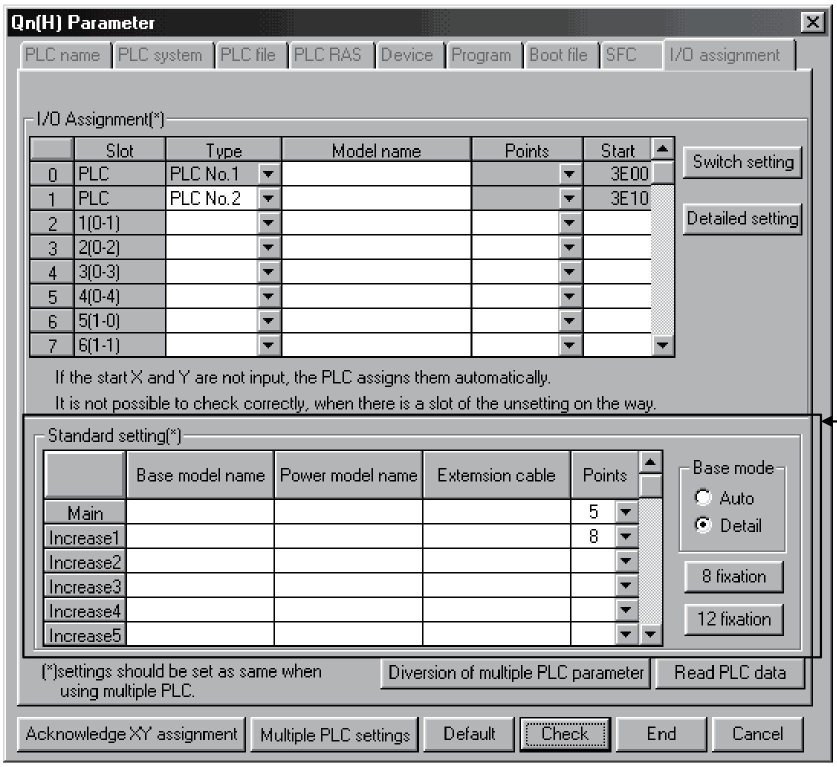
Main Base 5 slot

Extension Base

1st Stage	8	slot
2nd Stage	None	slot
3rd Stage	None	slot
4th Stage	None	slot
5th Stage	None	slot
6th Stage	None	slot
7th Stage	None	slot

Total number of bases and number of slots in each base

- I/O Assignment Settings (PLC CPU setting) in GX Developer



I/O Assignment(*)

	Slot	Type	Model name	Points	Start
0	PLC	PLC No.1			3E00
1	PLC	PLC No.2			3E10
2	1(0-1)				
3	2(0-2)				
4	3(0-3)				
5	4(0-4)				
6	5(1-0)				
7	6(1-1)				

If the start X and Y are not input, the PLC assigns them automatically.
It is not possible to check correctly, when there is a slot of the unsetting on the way.

Standard setting(*)

	Base model name	Power model name	Extension cable	Points
Main				5
Increase1				8
Increase2				
Increase3				
Increase4				
Increase5				

Base mode
○ Auto
● Detail

(*)settings should be set as same when using multiple PLC.

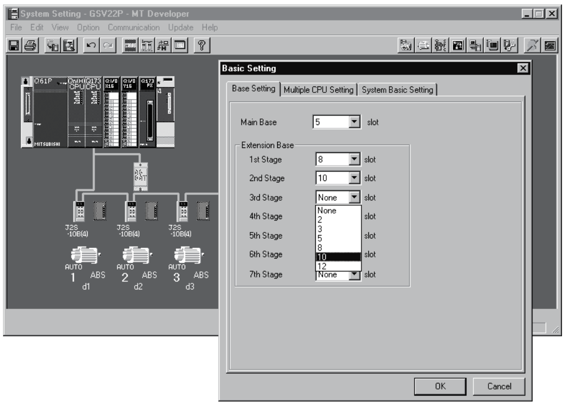
(Note) : Only the Motion CPU may be set without setting the PLC CPU.

POINT

GOT is recognized as an intelligent function modules "16 points × 10 slots" on the base (number of extension bases and slot No. are set in the GOT parameter.) for bus connection with GOT.
Set the one extension base (16 points × 10 slots) for connection with GOT, then set "10 slots" as number of extension bases for connection with GOT in the system setting (base setting).

<Example>

When the "2nd stage" of extension base is set as connection with GOT.
(Set "10" slot as "2nd stage" of extension base in the base setting.)



Main Base: 5 slot

Extension Base

1st Stage	8	slot
2nd Stage	10	slot
3rd Stage	None	slot
4th Stage		slot
5th Stage		slot
6th Stage		slot
7th Stage	None	slot

If the bus connection with GOT is executed without above settings in the base setting of system setting, "SP.UNIT LAY ERROR" (error code: 2124) will occur.

1.5.3 Individual parameters

(1) Basic system settings

The following explains each item to be set in Basic System Settings.

(a) Operation cycle setting

1) Set the of motion operation cycle (cycles at which a position command is computed and sent to the servo amplifier).
The setting range is 0.8ms/1.7ms/3.5ms/7.1ms/14.2ms/Automatic setting. The actual operation cycle corresponding to 0.8ms is 0.888...ms. Similarly, 1.7ms corresponds to 1.777...ms, 3.5ms to 3.555...ms, 7.1ms to 7.111...ms, and 14.2ms to 14.222…ms, respectively.

2) The default value is "Automatic setting". When "Automatic setting" is selected, the operation cycle is set according to the table below based on the number of axes for servo amplifier set in the System Settings.

Operating system	Number of axes	Operation cycle setting
SV13	1 to 8 axes	0.8 ms
	9 to 16 axes	1.7 ms
	17 to 32 axes	3.5 ms
SV22	1 to 4 axes	0.8 ms
	5 to 12 axes	1.7 ms
	13 to 24 axes	3.5 ms
	25 to 32 axes	7.1 ms

3) If the duration of motion operation has exceeded the operation cycle, the operation cycle over flag (M2054) turns ON. Even when "Automatic setting" is selected, the duration of motion operation may exceed the operation cycle depending on the control conditions. The actual duration of motion operation (unit:μs) is stored in the D9188, and the current setting of operation cycle (unit:μs) is stored in the D9197. Monitor these special registers and adjust the set value of operation cycle so that the actual duration of motion operation will not exceed the set operation cycle. (A WDT or other error may occur in the Motion CPU.)

4) The MR-H□BN does not support an operation cycle of 0.8 [ms]. If the MR-H□BN is set in the System Settings, 1.7 [ms] is used as the actual operation cycle even when 0.8 [ms] is set.

5) The MR-J2S-□B supports an operation cycle of 0.8 [ms] and 1.7 [ms] in version B0 or later. When using the MR-J2S-□B of Version A4 or earlier, set the operation cycle as 3.5 [ms] or more.

6) The vector inverter does not support an operation cycle of 0.8 [ms] and 1.7 [ms]. If the FR-V500 is set in the System Setting, 3.5[ms] is used as the actual operation cycle even when 0.8 [ms] or 1.7 [ms] is set.

(b) Operation setting upon STOP → RUN

Set the condition in which the "PLC ready" flag (M2000) turns ON. Select one of the following:

1) M2000 ON upon switching (STOP → RUN) (default)

Condition in which the M2000 turns from OFF to ON

- Change the RUN/STOP switch from the STOP side to the RUN side.
- With the RUN/STOP switch set to the RUN side, turn ON the power or cancel the reset.

Condition in which the M2000 turns from ON to OFF

- Change the RUN/STOP switch from the RUN side to the STOP side.

2) M2000 ON upon switching (STOP → RUN) + 1 set in setting register

(The M2000 turns ON when the switch is set to the RUN side and 1 is set in the setting register.)

Condition in which the M2000 turns from OFF to ON

- With the RUN/STOP switch set to the RUN side, set 1 in the setting register for "PLC ready" flag (D704). (The Motion CPU detects a change from 0 to 1 in the lowest bit in the D704).

Condition in which the M2000 turns from ON to OFF

- With the RUN/STOP switch set to the RUN side, set 0 in the setting register for "PLC ready" flag (D704). (The Motion CPU detects a change from 1 to 0 in the lowest bit in the D704).
- Change the RUN/STOP switch from the RUN side to the STOP side.

(c) Forced stop input setting

Specify the bit device used for executing a forced stop in which all servo-amplifier axes are stopped immediately.

Either X (PX) or M can be specified. No default value has been set. The set bit device is designated as contact B and performs the following control in response to ON/OFF of the device.

- Bit device is turned OFF --- Forced stop input is ON (forced stop)
- Bit device is turned ON --- Forced stop input is OFF (forced stop is released.)

(d) Latching range setting

Set the following latching ranges for M, B, F, D and W, respectively.

- Range in which the latch can be cleared with the latch clear key (Latch (1))
- Range in which the latch cannot be cleared with the latch clear key (Latch (2))

(2) Individual module settings

The setting items for each module are shown below.

Setting items for each module

Module name		Item	Setting range	Initial value	Number of usable modules	
					Q173CPU(N)	Q172CPU(N)
Q172LX	Servo external signals input module	External signal setting	Set the number of axes for which the 8 axes input is used.	1 to 8 axes used	4	1
		DOG/CHANGE turning OFF to ON/ON to OFF	DOG/CHANGE input turning OFF to ON or turning ON to OFF	Turning OFF to ON		
		Input response time	0.4/0.6/1 ms (DOG/CHANGE response time)	0.4 ms		
Q172EX	Serial encoder input module	Serial encoder use setting	Used/Unused	Unused	6 (SV22)	4 (SV22)
		Serial encoder selecting	Q170ENC/MR-HENC	• Q172EX(-S1) use MR-HENC • Q172EX-S2/S3 use Q170ENC		
		Input response time	0.4/0.6/1 ms (TREN response time)	0.4 ms		
		High-speed read setting	Used/Unused	Unused		
Q173PX	Manual pulse generator input module	Manual pulse generator setting (SV13)	Used only	Used	1 (SV13) 4 (SV22)	1 (SV13) 3 (SV22)
		Serial encoder/Manual pulse generator setting (SV22)	Used/Unused	P□ Used		
		Input response time	0.4/0.6/1 ms (TREN response time)	0.4 ms		
		High-speed read setting	Used/Unused	Unused		
QI60	Interrupt module	Input response time	0.1/0.2/0.4/0.6/1 ms	0.2 ms	1	1

Setting items for each module (Continued)

Module name		Item	Setting range	Initial value	Number of usable modules	
					Q173CPU(N)	Q172CPU(N)
QX□/ QX□-S1	Input module	First I/O No.	00 to FF0 (in units of 16 points)	0	Total 256 points or less	Total 256 points or less
		Number of I/O points	0/16/32/64/128/256	16		
		High-speed read setting	Used/Unused	Unused		
		Input response time setting (setting for high-speed input module in parentheses)	1/5/10/20/70 ms (0.1/0.2/0.4/0.6/1 ms)	10 ms (0.2 ms)		
QY□	Output module	First I/O No.	00 to FF0 (in units of 16 points)	0		
		Number of I/O points	0/16/32/64/128/256	16		
QH□/QX□Y□	Input/Output composite module	First I/O No.	00 to FF0 (in units of 16 points)	0		
		Number of I/O points	0/16/32/64/128/256	16		
		Input response time setting	1/5/10/20/70 ms	10 ms		
		High-speed read setting	Used/Unused	Unused		
Q6□AD□/ Q6□AD-□	Analogue input module (Note-1)	First I/O No.	00 to FF0 (in units of 16 points)	0		
		Input range setting	4 to 20mA/0 to 20mA/1 to 5V/0 to 5V/-10 to 10V/0 to 10V/User range	4 to 20mA		
		Temperature drift compensation	Used/None	Used		
		Resolution mode	Normal/High	Normal		
		Operation mode	Normal (A/D conversion)/Offset gain setting	Normal (A/D conversion)		
Q6□DA□/ Q6□DA-□	Analogue output module (Note-1)	First I/O No.	00 to FF0 (in units of 16 points)	0		
		Output range setting	4 to 20mA/0 to 20mA/1 to 5V/0 to 5V/-10 to 10V/User range	4 to 20mA		
		HOLD/CLEAR function setting	CLEAR only	CLEAR		
		Output mode	Normal (Asynchronous)/ Synchronous output	Normal (Asynchro-nous)		
		Resolution mode	Normal/High	Normal		
		Operation mode	Normal (D/A conversion)/ Offset gain setting	Normal (D/A conversion)		

(Note-1) : A maximum of 4 modules, analogue input modules and analogue output modules, can be used.

(3) System setting errors

Motion CPUs generate a system configuration error under the following conditions:

Error name	Error code (Note-1)	Error cause	Check timing	Operation at error occurrence
LAY ERROR (SL ∗ ∗)	10000 (Note-2)	• The slot set in system settings is vacant or a different module is installed.	When the power is turned ON/ the key is reset	Cannot be started. (Motion CPU system setting error)
AXIS No. MULTIDEF		• Duplicate axis No. is set in system settings.		
AMP No. SETTING		• Not a single axis is set in system settings.		
SYS.SET DATA ERR		• System setting data is not written. • System setting data is written without relative check. Or it is written at the state of error occurrence.		
AXIS No. ERROR		• System setting data is not written.		
I/O POINTS OVER		• The number of actual I/O points set in system settings exceeds 256.		
SP. UNIT LAY ERROR	2121	• A CPU module is installed in a slot except for a CPU slot or slot 0 to 2.		Cannot be started. (Multiple CPU system CPU DOWN error)
SP. UNIT LAY ERROR	2124 (Note-3)	• A module is installed in slot 65 or subsequent slot. • A module is installed in a base for which "None" is set in base settings.		
SP. UNIT LAY ERROR	2126	• There are non-installation slots between the CPU modules. • The modules except for the PLC CPU are installed between the PLC CPU modules.		
PARAMETER ERROR	3010	• The number of CPU modules set in the parameter differ from the real installation in a Multiple CPU system.		
PARAMETER ERROR	3012	• The reference CPU No. set in the parameter differ from the setting in a Multiple CPU system.		
PARAMETER ERROR	3013	Multiple CPU automatic refresh setting is any of the followings in a Multiple CPU system. • When a bit device is set as a refreshed, a number except for a multiple of 16 is set as the refresh first device. • A non-specifiable device is specified. • The number of transmitting points is an odd number.		
MULTI EXE. ERROR	7010	• A fault CPU is installed in a Multiple CPU system. • CPUs of unmatched versions are installed in a Multiple CPU system. (An error is detected at the PLC CPU of function version B.) • Any CPU No. among CPU No.2 to 4 was reset, after power on a Multiple CPU system. (This error occurs by the reset CPU No.)		

(Note-1) : The error code stored in the diagnosis error area of the self operation information area in the Multiple CPU shared memory.

(Note-2) : When an error code 10000 is displayed, the M2041 ("System setting error" flag) turns ON and an applicable error name shown above is displayed on the error list monitor of the programming software package.

(Note-3) : Base settings must be performed in System Settings of the Motion CPU even for those bases in which the modules controlled by the self CPU are not installed.

1.6 Assignment of I/O No.

I/O No.s used in the Multiple CPU system include those used by the Motion CPU to communicate with I/O modules/intelligent function modules and those used in the communication between the PLC CPU and the Motion CPU. The following explains each I/O No. and assignment of I/O No..

1.6.1 I/O No. for I/O modules and intelligent function modules

In the Multiple CPU system, the "0H" position(slot) of I/O No. which seen from the PLC CPU is different from the position in the case of a standalone CPU. However, I/O No. of the control module may be assigned independently for each CPU in the Motion CPU.

(1) "0H" position of I/O No.

(a) In the Multiple CPU system, the slots corresponding to the number of units set by a multiple CPU parameter are occupied by the PLC CPU/Motion CPU.

(b) I/O modules and intelligent function modules are installed in slots available to the right of those occupied by the PLC CPU/Motion CPU.

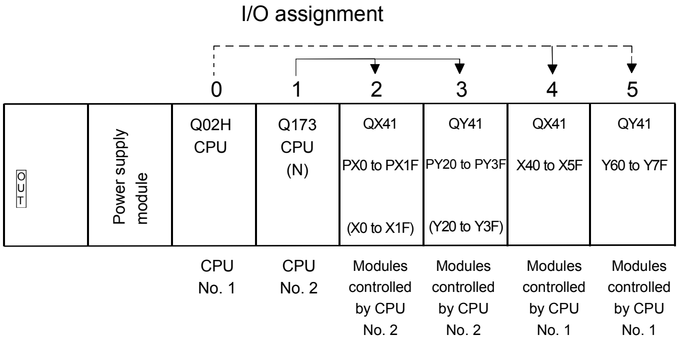
(c) I/O No. of the control module may be assigned independently for each CPU in the Motion CPU. I/O No. of the PLC CPU control modules are assigned sequentially toward the right, starting from "0H" being the I/O module or intelligent function module installed to the immediate right of the slots occupied by the PLC CPU/Motion CPU.

(d) Notation of I/O No.

- Receiving of ON/OFF data by the Motion CPU is deemed input (PX), while outputting of ON/OFF data from the Motion CPU is deemed output (PY).
- I/O No. is expressed in hexadecimal.

(2) Assignment of I/O No. to the Motion CPU control module

Mitsubishi recommends that I/O No. assignment be set as common consecutive No. throughout all CPUs.
However, the I/O No. of the Motion CPUs control input modules, output modules and input/output composite modules may also be set independently of the I/O No. of the PLC CPU control modules.
(The I/O No. of the Motion CPU control modules are indicated with a PX/PY.)
The I/O No. of the Motion CPU control modules are invalid during I/O Assignment Settings of the PLC CPU.



(3) Setting of the Motion CPU control modules by the PLC CPU

(a) Type/number of points

Follow the table below when Motion CPU control modules are set in I/O Assignment Settings of the PLC CPU. (The PLC CPU handles the Q172LX, Q172EX and Q173PX as intelligent function modules having 32 occupied points.) Type and number of points may be left unset.

Module name	Type	Number of points	Remarks
Input module	Input	Selected according to the module.	• For the control CPU, set the CPU that corresponds to the Motion CPU (required). • Type and number of points may be left unset.
Output module	Output		
Input/Output composite module	Composite I/O		
Analogue input module	Analogue input	16 points	
Analogue output module	Analogue output		
Interrupt module (QI60)	Interrupt		
Q172LX	Intelligent	32 points	
Q172EX		32 points	
Q173PX		32 points	

POINT

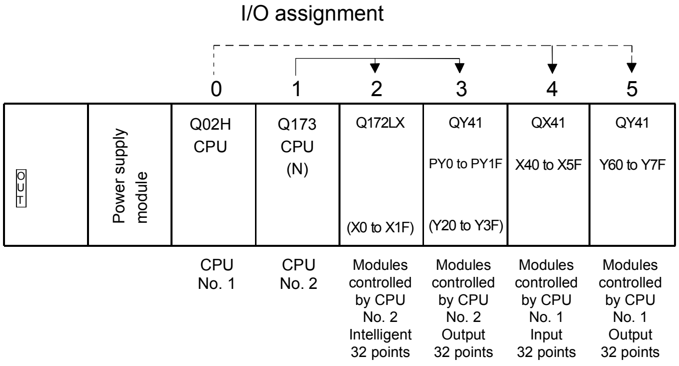
(1) Set the I/O device of the Motion CPU within the range from PX/PY000 to PX/PYFFF. Set the number of real I/O points within 256 points. (I/O No. may not be consecutive.)

(2) As for the Motion CPU, the Q172LX, Q172EX, Q173PX and QI60 are not included in the number of real I/O points.

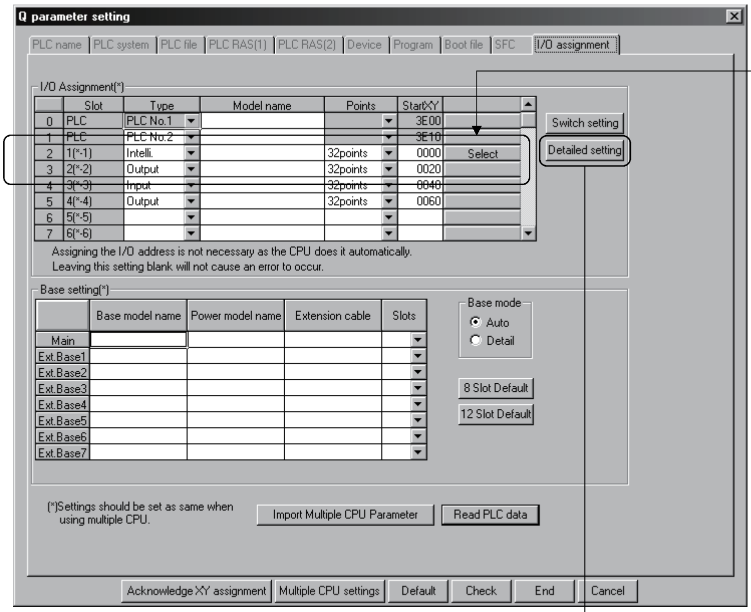
(b) If the installed Motion CPU control module is different from the I/O assignment type of PLC CPU, the operation is abnormal.

Name of installed Motion CPU control module	I/O assignment type of PLC CPU	Operation
Input module	High-speed input/Output/Composite I/O	Operation is abnormal. (An error does not occur.)
	Interrupt/Intelligent	Error 2100 (SP.UNIT LAY ERR.)
Output module	Input/High-speed input/Composite I/O	Operation is abnormal. (An error does not occur.)
	Interrupt/Intelligent	Error 2100 (SP.UNIT LAY ERR.)
Input/Output composite module	Input/High-speed input/Output	Operation is abnormal. (An error does not occur.)
	Interrupt/Intelligent	Error 2100 (SP.UNIT LAY ERR.)
Analogue input module, Analogue output module, Q172LX, Q172EX, Q173PX	Input/High-speed input/Output/ Composite I/O	Error 2100 (SP.UNIT LAY ERR.)
	Interrupt	Operation is abnormal. (An error does not occur.)
Interrupt module (QI60)	Input/High-speed input/Output/ Composite I/O	Error 2100 (SP.UNIT LAY ERR.)
	Intelligent	Operation is abnormal. (An error does not occur.)
All module	Not used	Operation is abnormal. (An error does not occur.)

(c) Example of setting


I/O assignment
0
1
2
3
4
5
OUT
Power supply module
Q02H CPU
Q173 CPU (N)
Q172LX
(X0 to X1F)
QY41
PY0 to PY1F
(Y20 to Y3F)
QX41
X40 to X5F
QY41
Y60 to Y7F
CPU No. 1
CPU No. 2
Modules controlled by CPU No. 2 Intelligent 32 points
Modules controlled by CPU No. 2 Output 32 points
Modules controlled by CPU No. 1 Input 32 points
Modules controlled by CPU No. 1 Output 32 points

I/O Assignment Settings (PLC CPU setting) in GX Developer



I/O Assignment(*)

	Slot	Type	Model name	Points	StartXY	
0	PLC	PLC No.1			3E00	
1	PLC	PLC No.2			3E10	
2	1(*-1)	Intelli.		32points	0000	Select
3	2(*-2)	Output		32points	0020	
4	3(*-3)	Input		32points	0040	
5	4(*-4)	Output		32points	0060	
6	5(*-5)					
7	6(*-6)					

Assigning the I/O address is not necessary as the CPU does it automatically.
Leaving this setting blank will not cause an error to occur.

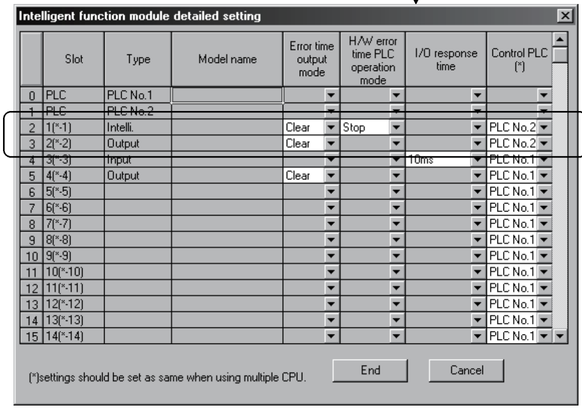
Base setting(*)

	Base model name	Power model name	Extension cable	Slots
Main				
Ext.Base1				
Ext.Base2				
Ext.Base3				
Ext.Base4				
Ext.Base5				
Ext.Base6				
Ext.Base7				

Base mode
● Auto
○ Detail

(*)Settings should be set as same when using multiple CPU.

Setting of type/ number of points



	Slot	Type	Model name	Error time output mode	H/W error time PLC operation mode	I/O response time	Control PLC (*)
0	PLC	PLC No.1					
1	PLC	PLC No.2					
2	1(*-1)	Intelli.		Clear	Stop		PLC No.2
3	2(*-2)	Output		Clear			PLC No.2
4	3(*-3)	Input				10ms	PLC No.1
5	4(*-4)	Output		Clear			PLC No.1
6	5(*-5)						PLC No.1
7	6(*-6)						PLC No.1
8	7(*-7)						PLC No.1
9	8(*-8)						PLC No.1
10	9(*-9)						PLC No.1
11	10(*-10)						PLC No.1
12	11(*-11)						PLC No.1
13	12(*-12)						PLC No.1
14	13(*-13)						PLC No.1
15	14(*-14)						PLC No.1

(*)settings should be set as same when using multiple CPU.

Setting of control CPU etc.

1.6.2 I/O No. of PLC CPU and Q173CPU(N)/Q172CPU(N)

In the Multiple CPU system, I/O No. is assigned to the PLC CPU/Motion CPU to enable communication between the PLC CPU and Motion CPU using the following instructions:

- The Multiple CPU dedicated instructions
- The Motion CPU dedicated instructions
- The Multiple CPU communication dedicated instructions

The I/O No. of the PLC CPU/Motion CPU are fixed based on the installed slots and cannot be changed.

The table below lists the I/O No. of the PLC CPU/Motion CPU installed in the CPU base unit of the Multiple CPU system.

CPU installation position	QCPU slot	Slot 0	Slot 1	Slot 2
Head I/O number	3E00H	3E10H	3E20H	3E30H

The I/O No. of the PLC CPU/Motion CPU are used in the following cases:

- When writing data to the shared CPU memory of the self CPU using the S. TO instruction.
- When reading data from the shared CPU memory of the other CPU using the FROM instruction.
- When reading data from the shared CPU memory of the other CPU using an intelligent function module device (U□\G□)
- When reading device data directly from the Motion CPU from the PLC CPU using the "S(P). DDRD" instruction.
- When writing device data directly to the Motion CPU from the PLC CPU using the "S(P).DDWR" instruction.

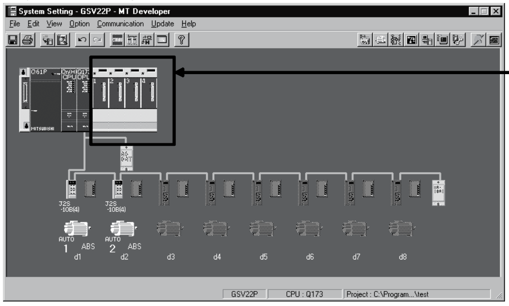
REMARK

- Refer to Chapter "3. COMMUNICATION BETWEEN THE PLC CPU AND THE MOTION CPU IN THE MULTIPLE CPU SYSTEM" for communication between the PLC CPU and the Motion CPU.

1.6.3 Setting I/O No.

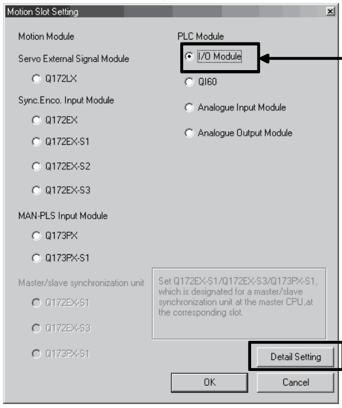
The procedure for the I/O No. setting for the Motion CPU in System Settings of SW6RN-GSV□P is shown below. In the Motion CPU, by setting a module used in each CPU base or extension base slot in System Settings, the control CPU of the applicable slot is assigned as the self CPU. Input modules, output modules and composite I/O modules require an I/O No. to be set.
Refer to the help of SW6RN-GSV□P for the detailed operating procedure on the System Settings screen.

<System Settings>


System Setting - GSV22P - MT Developer
File Edit View Option Communication Update Help
d1
d2
d3
d4
d5
d6
d7
d8
GSV22P
CPU : Q173
Project : C:\Program...\test

1) Double-click the slot position, display the Motion Slot Settings dialog box.

<Motion Slot Settings>


Motion Slot Setting

Motion Module

Servo External Signal Module
○ Q172LX

Sync.Enco. Input Module
○ Q172EX
○ Q172EX-S1
○ Q172EX-S2
○ Q172EX-S3

MAN-PLS Input Module
○ Q173PX
○ Q173PX-S1

Master/slave synchronization unit
○ Q172EX-S1
○ Q172EX-S3
○ Q173PX-S1

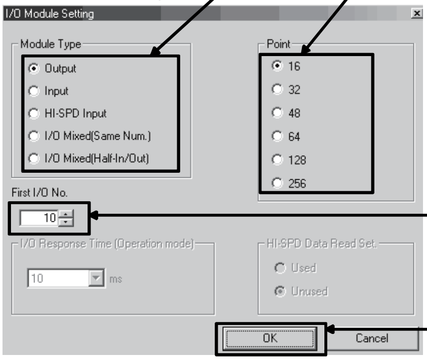
PLC Module
● I/O Module
○ QI60
○ Analogue Input Module
○ Analogue Output Module

Set Q172EX-S1/Q172EX-S3/Q173PX-S1, which is designated for a master/slave synchronization unit at the master CPU,at the corresponding slot.

2) Select the I/O module.

3) Click [Detail Setting].

<I/O Module Settings>


I/O Module Setting

Module Type
● Output
○ Input
○ HI-SPD Input
○ I/O Mixed(Same Num.)
○ I/O Mixed(Half-In/Out)

Point
● 16
○ 32
○ 48
○ 64
○ 128
○ 256

First I/O No. 10

I/O Response Time (Operation mode) 10 ms

HI-SPD Data Read Set
○ Used
● Unused

4) Select applicable module type and number of points for the I/O module to be used.

5) Set the first I/O No. (PX No., PY No.).

6) Click [OK].

(Note): Display of system setting and motion slot setting are different depending on the operating system software.

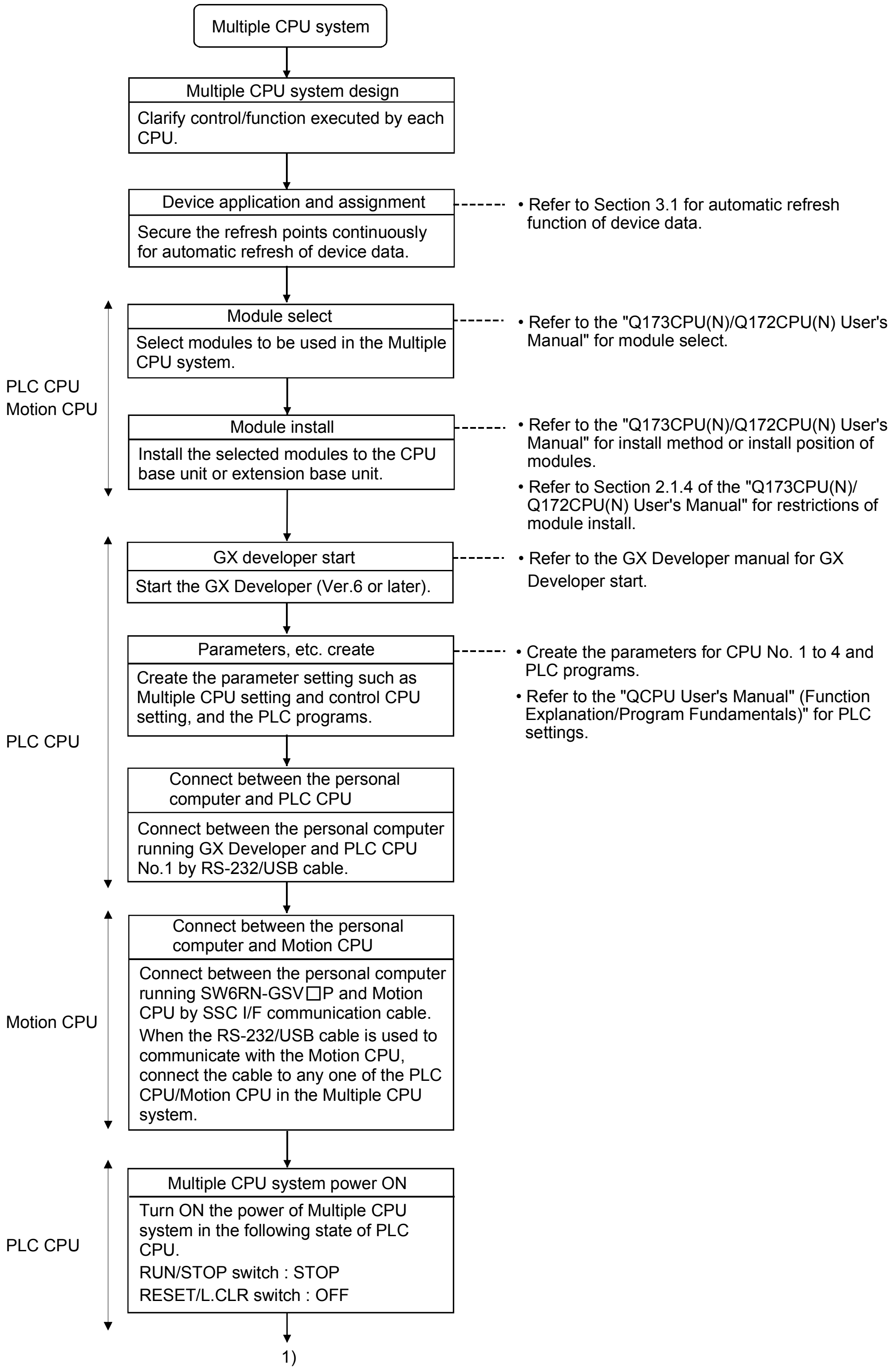
POINT

I/O No.s cannot be assigned automatically, unlike a PLC CPU for which I/O No. are assigned automatically if such setting is omitted in the Motion CPU. In the Motion CPU, be sure to set the first I/O No. in System Settings for each module used.

2. STARTING UP THE MULTIPLE CPU SYSTEM

This section describes a standard procedure to start up the Multiple CPU system.

2.1 Startup Flow of the Multiple CPU System



Multiple CPU system

Multiple CPU system design
Clarify control/function executed by each CPU.

Device application and assignment
Secure the refresh points continuously for automatic refresh of device data.

- Refer to Section 3.1 for automatic refresh function of device data.

PLC CPU
Motion CPU

Module select
Select modules to be used in the Multiple CPU system.

- Refer to the "Q173CPU(N)/Q172CPU(N) User's Manual" for module select.

Module install
Install the selected modules to the CPU base unit or extension base unit.

- Refer to the "Q173CPU(N)/Q172CPU(N) User's Manual" for install method or install position of modules.
- Refer to Section 2.1.4 of the "Q173CPU(N)/ Q172CPU(N) User's Manual" for restrictions of module install.

PLC CPU

GX developer start
Start the GX Developer (Ver.6 or later).

- Refer to the GX Developer manual for GX Developer start.

Parameters, etc. create
Create the parameter setting such as Multiple CPU setting and control CPU setting, and the PLC programs.

- Create the parameters for CPU No. 1 to 4 and PLC programs.
- Refer to the "QCPU User's Manual" (Function Explanation/Program Fundamentals)" for PLC settings.

Connect between the personal computer and PLC CPU
Connect between the personal computer running GX Developer and PLC CPU No.1 by RS-232/USB cable.

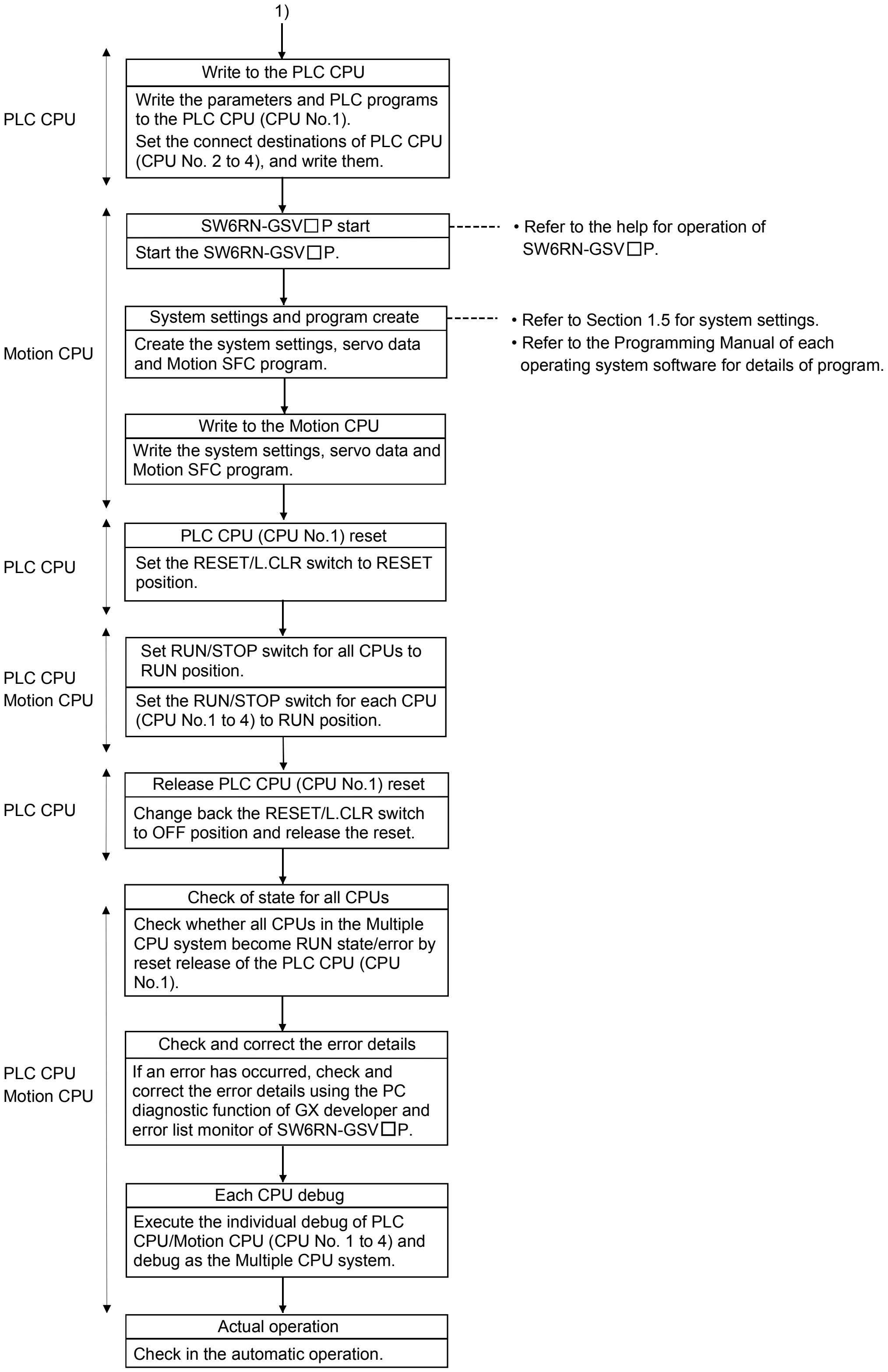
Motion CPU

Connect between the personal computer and Motion CPU
Connect between the personal computer running SW6RN-GSV□P and Motion CPU by SSC I/F communication cable.
When the RS-232/USB cable is used to communicate with the Motion CPU, connect the cable to any one of the PLC CPU/Motion CPU in the Multiple CPU system.

PLC CPU

Multiple CPU system power ON
Turn ON the power of Multiple CPU system in the following state of PLC CPU.
RUN/STOP switch : STOP
RESET/L.CLR switch : OFF

1)



1)

PLC CPU

Write to the PLC CPU

Write the parameters and PLC programs to the PLC CPU (CPU No.1).

Set the connect destinations of PLC CPU (CPU No. 2 to 4), and write them.

Motion CPU

SW6RN-GSV□P start

Start the SW6RN-GSV□P.

• Refer to the help for operation of SW6RN-GSV□P.

System settings and program create

Create the system settings, servo data and Motion SFC program.

• Refer to Section 1.5 for system settings.

• Refer to the Programming Manual of each operating system software for details of program.

Write to the Motion CPU

Write the system settings, servo data and Motion SFC program.

PLC CPU

PLC CPU (CPU No.1) reset

Set the RESET/L.CLR switch to RESET position.

PLC CPU
Motion CPU

Set RUN/STOP switch for all CPUs to RUN position.

Set the RUN/STOP switch for each CPU (CPU No.1 to 4) to RUN position.

PLC CPU

Release PLC CPU (CPU No.1) reset

Change back the RESET/L.CLR switch to OFF position and release the reset.

PLC CPU
Motion CPU

Check of state for all CPUs

Check whether all CPUs in the Multiple CPU system become RUN state/error by reset release of the PLC CPU (CPU No.1).

Check and correct the error details

If an error has occurred, check and correct the error details using the PC diagnostic function of GX developer and error list monitor of SW6RN-GSV□P.

Each CPU debug

Execute the individual debug of PLC CPU/Motion CPU (CPU No. 1 to 4) and debug as the Multiple CPU system.

Actual operation

Check in the automatic operation.

(Note) : Installation of the operating system software is required to the Motion CPU module before start of the Multiple CPU system.
Refer to Chapter 5 of the "Q173CPU(N)/Q172CPU(N) User's Manual" for installation of the Motion CPU operating system software.

3. COMMUNICATION BETWEEN THE PLC CPU AND THE MOTION CPU IN THE MULTIPLE CPU SYSTEM

The following tasks can be performed between the PLC CPU and the Motion CPU in the Multiple CPU system.

- Data transfer between CPUs by the automatic refresh function of the shared CPU memory
- Control instruction from the PLC CPU to Motion CPU by the Motion dedicated Instructions
- Reading/writing device data from the PLC CPU to Motion CPU by the dedicated instruction

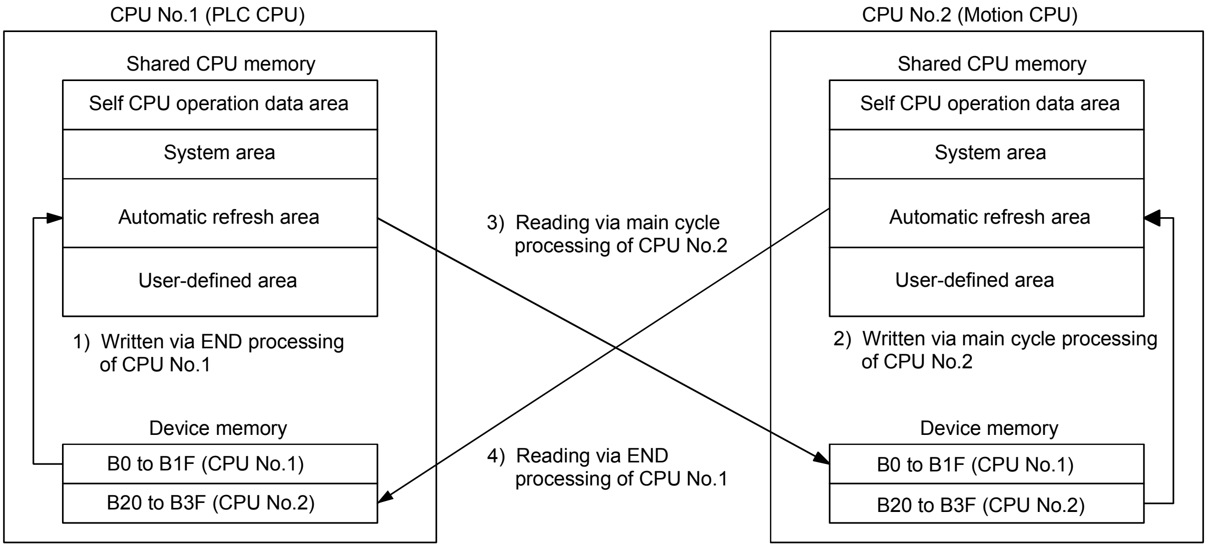
3.1 Automatic Refresh Function of The Shared CPU Memory

(1) Automatic refresh function of the shared CPU memory

(a) The automatic refresh function of the shared CPU memory is executed automatically the data transfer between CPUs in the Multiple CPU system during END processing in the PLC CPU or during main cycle processing (free time except motion control) in the Motion CPU.

When the automatic refresh function is used, the data in the device memory of the other CPU is read automatically, so the device data of other CPU can be used as the device data of self CPU.

The diagram below illustrates the automatic refresh operation involving 32 points (B0 to B1F) for the PLC CPU of CPU No.1 and 32 points (B20 to B3F) for the Motion CPU of CPU No.2.



Processing details of CPU No.1 (PLC CPU) at the END processing.

1) : Data of transmitting devices B0 to B1F for CPU No.1 is transferred to the automatic refresh area of shared memory in the self CPU.

4) : Data in the automatic refresh area of shared memory in CPU No.2 is transferred to B20 to B3F in the self CPU.

Processing details of CPU No.2 (Motion CPU) at main cycle processing.

2) : Data of transmitting devices B20 to B3F for CPU No.2 is transferred to the automatic refresh area of shared memory in the self CPU.

3) : Data in the automatic refresh area of shared memory in CPU No.1 is transferred to B0 to B1F in the self CPU.

By the above operations, the data written to B0 to B1F in CPU No.1 can be read as B0 to B1F of CPU No.2, while the data written to B20 to B3F in CPU No.2 can be read as B20 to B3F of CPU No.1. B0 to B1F of CPU No.1 can be read or written freely using CPU No.1, but B20 to B3F correspond to the refresh area for the data of CPU No.2 and can only be read, not written, by CPU No. 1. Similarly, B20 to B3F of CPU No.2 can be read or written freely using CPU No.2, but B0 to B1F correspond to the refresh area for the data of CPU No.1 and thus can only be read, not written, by CPU No.2.

(b) Executing the automatic refresh function

The automatic refresh function can be executed regardless of whether the applicable PLC CPU and Motion CPU are in the RUN or STOP state.
When a CPU DOWN error will occur in the PLC CPU or Motion CPU, the automatic refresh function is not executed.
When one CPU generated a CPU DOWN error, the other CPU free from CPU DOWN error retains the data saved immediately before the CPU DOWN error occurred. For example, if CPU No.2 generated a CPU DOWN error while B20 was ON in the operation block diagram in (a), B0 of CPU No.1 remains ON. If necessary, interlocking is performed using other-CPU DOWN detection signals M9244 to M9247.

(c) To execute the automatic refresh function, for the Motion CPU the number of transmitting points for the CPU and the devices whose data is stored (devices to which the automatic refresh function is executed) must be set in Multiple CPU Settings of System Settings. For the PLC CPU, the applicable parameters must be set identically in Multiple CPU Settings of PC parameters.

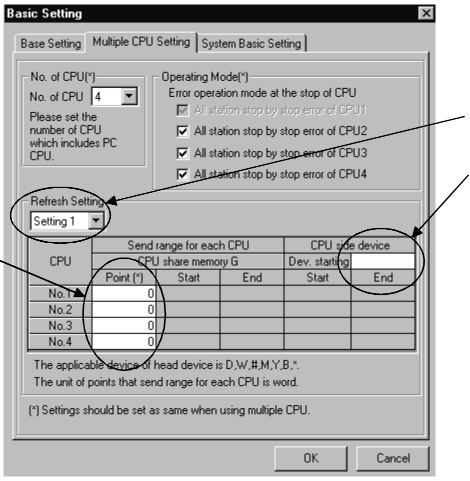
Item		Description
Type of refresh device	Bit	Y, M, B (Set the first device No. as a multiple of 16 in modules of 32 bits.)
	Word	D, W, # (Set in modules of 2 words.)
Number of refresh device range settings		4 ranges (Bit and word may be mixed.)
Number of refresh words per CPU		A maximum of 8k words
Number of transmitting words per CPU		A maximum of 2k words (Set in units of 2 words.)

⚠CAUTION

● If necessary, perform interlocking during the execution of the automatic refresh function using other CPU DOWN detection signals M9244 to M9247.

(2) Automatic refresh settings 1 (Automatic setting)

(a) When executing the automatic refresh function of shared CPU memory, set the number of each CPU's transmitting points and devices in which data is to be stored using Multiple CPU Settings of System Settings.
Refer to the "QCPU User's Manual (Function Explanation/Program Fundamentals)" about the setting of the PLC CPU.



Basic Setting

Base Setting | Multiple CPU Setting | System Basic Setting

No. of CPU(*)
No. of CPU: 4
Please set the number of CPU which includes PC CPU.

Operating Mode(*)
Error operation mode at the stop of CPU
☑ All station stop by stop error of CPU1
☑ All station stop by stop error of CPU2
☑ All station stop by stop error of CPU3
☑ All station stop by stop error of CPU4

Refresh Setting: Setting 1

CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. starting	
	Point (*)	Start	End	Start	End
No.1	0				
No.2	0				
No.3	0				
No.4	0				

The applicable device of head device is D,W,#,M,Y,B,*.
The unit of points that send range for each CPU is word.

(*) Settings should be set as same when using multiple CPU.

• Set the transmitting range for each CPU.

• Select the setting No..

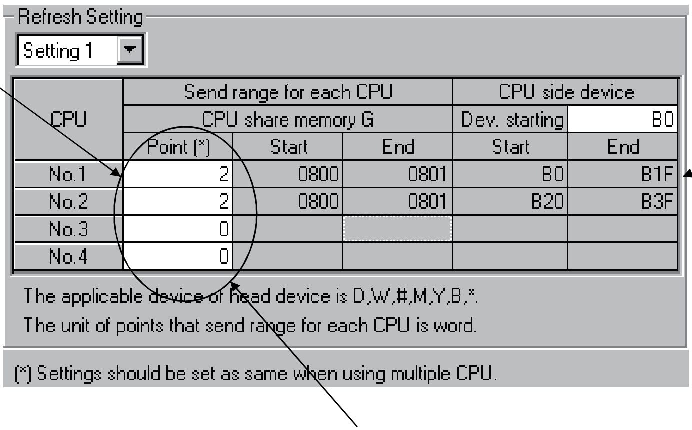
• Set the first device No. from which the automatic refresh function is executed. (Number of specified points are continuously used from the device No. to be set.)

(b) Setting number selection/send range (refresh range) for each CPU

1) The refresh setting of four ranges can be set by setting selection.
For example, ON/OFF data may be refreshed using bit-device setting, while other data may be refreshed using word device setting.

2) The number of points in the shared CPU memory set in units of 2 points (2 words) is set in the range for each CPU. (2 points if word device is specified for the CPU-side device, or 32 points if bit device is specified.)
Data of the CPUs for which "0" is set as the number of points representing the send range of the CPU will not be refreshed.
Assume that 32 points (B0 to B1F) of CPU No.1 and 32 points (B20 to B3F) of CPU No.2 are to be refreshed. Since one point in the shared CPU memory corresponds to 16 bit-device points, the number of transmitting points becomes 2 for CPU No. 1 and also 2 for CPU No. 2.

3) The maximum number of transmitting points combining all four ranges is 2k words per CPU (PLC CPU or Motion CPU) or 8k points (8k words) for all CPUs.



Refresh Setting: Setting 1

CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. starting	B0
	Point (*)	Start	End	Start	End
No.1	2	0800	0801	B0	B1F
No.2	2	0800	0801	B20	B3F
No.3	0				
No.4	0				

The applicable device of head device is D,W,#,M,Y,B,*.
The unit of points that send range for each CPU is word.

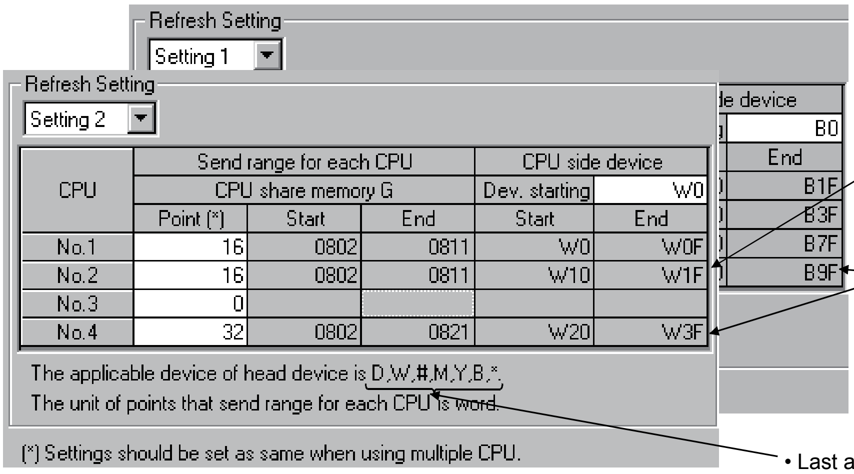
(*) Settings should be set as same when using multiple CPU.

• 2k points (2k words) per CPU
• 8k points (8k words) for all CPUs
• Set in units of 2 points (2 words).

• Setting two points in shared CPU memory and specifying the bit device for the CPU-side device creates 32 bit-device points.

• Data in CPU No.3 and 4 is not refreshed since the number of points is set to 0.

4) The shared CPU memory to be occupied during execution of the automatic refresh function covers all areas corresponding to settings 1 to 4.
When the number of transmitting points is set, the first and last addresses of the shared CPU memory to be used are indicated in hexadecimals.
The CPU for which the number of transmitting points is set in settings 1 and 2 use the last address of shared CPU memory in setting 2. (In the example below, CPU No.1 and No.2 are using the area up to 811H, while CPU No.4 is using the area up to 821H.)
The CPU for which the number of transmitting points is set only in setting 1 use the last address of shared CPU memory in setting 1. (In the example below, CPU No.3 is using the last address in setting 1).



Refresh Setting

Setting 2

CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. starting	W0
	Point (*)	Start	End	Start	End
No.1	16	0802	0811	W0	W0F
No.2	16	0802	0811	W10	W1F
No.3	0				
No.4	32	0802	0821	W20	W3F

The applicable device of head device is D,W,#,M,Y,B,*.
The unit of points that send range for each CPU is word.

(*) Settings should be set as same when using multiple CPU.

• Send range for CPU No.1

• Last address of CPU-side device

• Last address of the shared CPU memory for each CPU

5) Set the same number of transmitting points for all CPUs in the Multiple CPU system.
If any of the CPUs has a different number of transmitting points, a PARAMETER ERROR will be occurred.

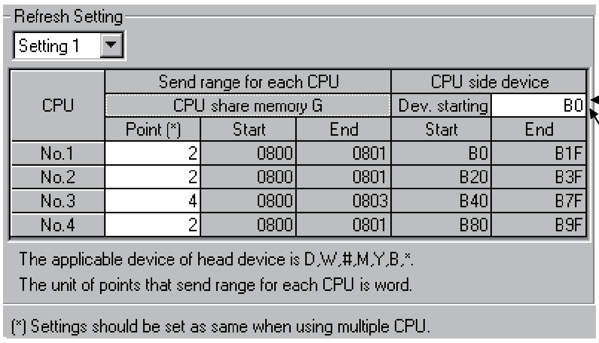
(c) CPU-side device
The following devices can be used for automatic refresh. (Other devices cannot be set in SW6RN-GSV□P.)

Settable device	Restriction
Data resister (D) Link resister (W) Motion resister (#)	None
Link relay (B) Internal relay (M) Output (Y)	• Specify 0 or a multiple of 16 as the first No.. • One transmitting point occupies 16 points.

1) As for the CPU-side devices, the devices corresponding to the total number of transmitting points set for CPU No.1 to 4 in one setting range are used in succession starting from the device No. to be set.
Set a device number that ensures enough devices for the set transmitting points.
When bit device is specified for the CPU-side device, the number of transmitting points is multiplied by 16.

2) Set the CPU-side device as follows.
- Settings 1 to 4 may use different devices.
  If the device ranges do not overlap, the same device may be used for settings 1 to 4.

Setting 1: Link relay



Refresh Setting

Setting 1

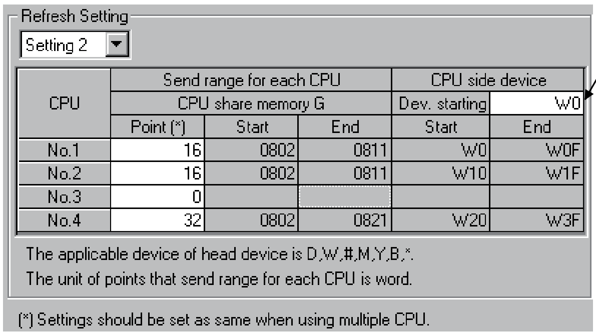
CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. starting	B0
	Point (*)	Start	End	Start	End
No.1	2	0800	0801	B0	B1F
No.2	2	0800	0801	B20	B3F
No.3	4	0800	0803	B40	B7F
No.4	2	0800	0801	B80	B9F

The applicable device of head device is D,W,#,M,Y,B,*.
The unit of points that send range for each CPU is word.

(*) Settings should be set as same when using multiple CPU.

- Settings 1 to 4 may use different devices.

Setting 2: Link register



Refresh Setting

Setting 2

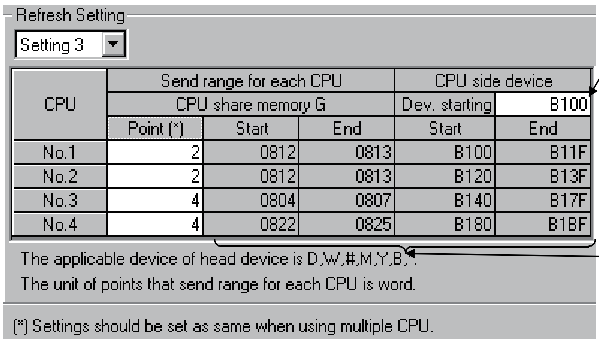
CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. starting	W0
	Point (*)	Start	End	Start	End
No.1	16	0802	0811	W0	W0F
No.2	16	0802	0811	W10	W1F
No.3	0				
No.4	32	0802	0821	W20	W3F

The applicable device of head device is D,W,#,M,Y,B,*.
The unit of points that send range for each CPU is word.

(*) Settings should be set as same when using multiple CPU.

- The same device may be used for settings 1 to 4.
  In setting 1 shown to the left, 160 points from B0 to B9F are used. Therefore, setting 3 can use device No. after BA0.
  Device numbers may not overlap even partially, such as specifying B0 to B9F in setting 1 and B90 to B10F in setting 3.

Setting 3: Link relay



Refresh Setting

Setting 3

CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. starting	B100
	Point (*)	Start	End	Start	End
No.1	2	0812	0813	B100	B11F
No.2	2	0812	0813	B120	B13F
No.3	4	0804	0807	B140	B17F
No.4	4	0822	0825	B180	B1BF

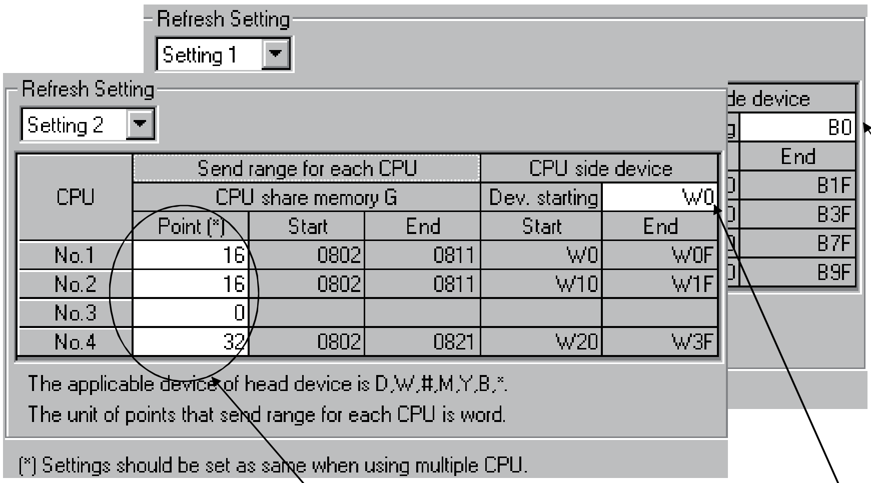
The applicable device of head device is D,W,#,M,Y,B,*.
The unit of points that send range for each CPU is word.

(*) Settings should be set as same when using multiple CPU.

- The first and last addresses are calculated automatically in SW6RN-GSV□P.

- The devices in settings 1 to 4 can be set individually for each CPU. For example, you may set link relay for CPU No.1 and internal relay for CPU No.2.

Refresh settings of CPU No.1



Refresh Setting

Setting 1

de device	
g	B0
	End
0	B1F
0	B3F
0	B7F
0	B9F

Refresh Setting

Setting 2

CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. starting	W0
	Point (*)	Start	End	Start	End
No.1	16	0802	0811	W0	W0F
No.2	16	0802	0811	W10	W1F
No.3	0				
No.4	32	0802	0821	W20	W3F

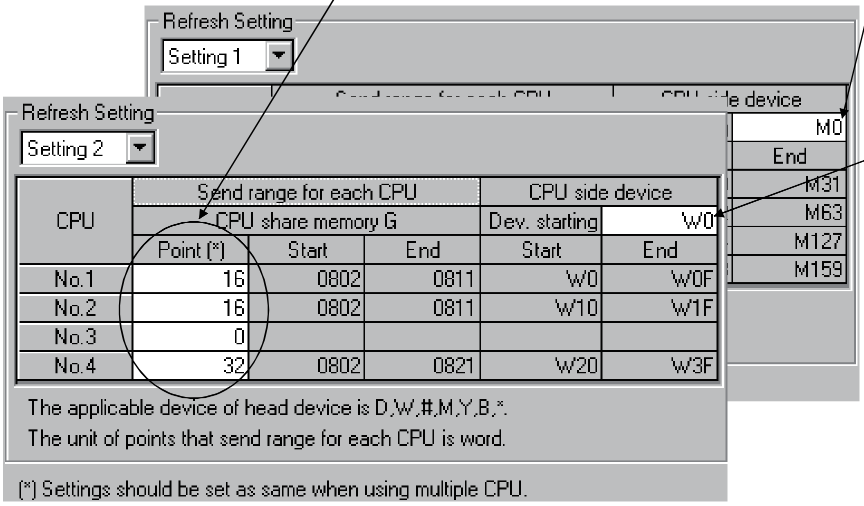
The applicable device of head device is D,W,#,M,Y,B,*.
The unit of points that send range for each CPU is word.

(*) Settings should be set as same when using multiple CPU.

- When the CPU-side device for CPU No.1 is different from that for CPU No.2.

- Set the same number of points for all CPUs.

Refresh settings of CPU No.2



Refresh Setting

Setting 1

de device	
	M0
	End
	M31
	M63
	M127
	M159

Refresh Setting

Setting 2

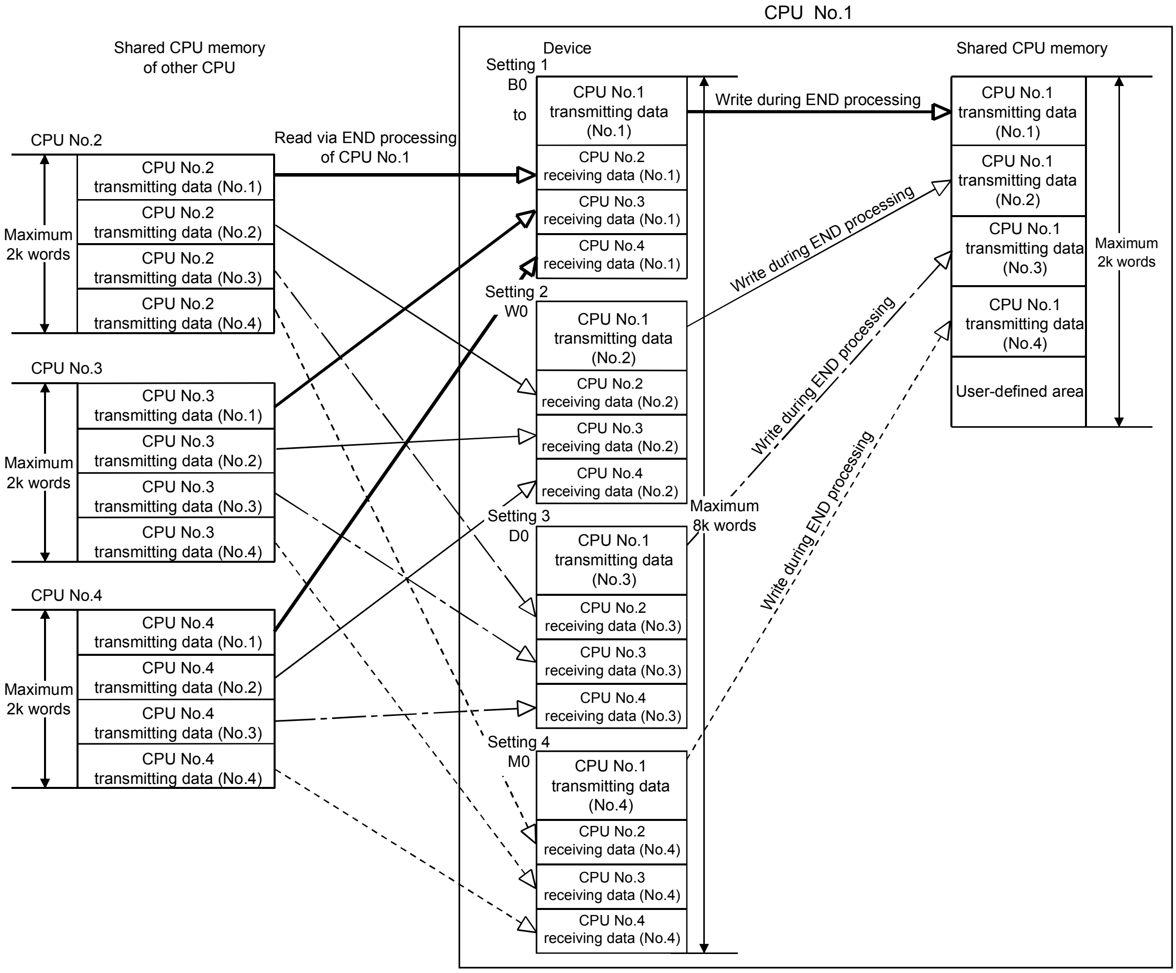
CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. starting	W0
	Point (*)	Start	End	Start	End
No.1	16	0802	0811	W0	W0F
No.2	16	0802	0811	W10	W1F
No.3	0				
No.4	32	0802	0821	W20	W3F

The applicable device of head device is D,W,#,M,Y,B,*.
The unit of points that send range for each CPU is word.

(*) Settings should be set as same when using multiple CPU.

- When the CPU-side device for CPU No.1 is the same as that for CPU No.2.

3) The block diagram below illustrates the automatic refresh operation over four ranges of setting 1: link relay (B), setting 2: link register (W), setting 3: data register (D), and setting 4: internal relay (M).


CPU No.1
Shared CPU memory of other CPU
Device
Shared CPU memory
CPU No.2
CPU No.2 transmitting data (No.1)
CPU No.2 transmitting data (No.2)
CPU No.2 transmitting data (No.3)
CPU No.2 transmitting data (No.4)
Maximum 2k words
CPU No.3
CPU No.3 transmitting data (No.1)
CPU No.3 transmitting data (No.2)
CPU No.3 transmitting data (No.3)
CPU No.3 transmitting data (No.4)
Maximum 2k words
CPU No.4
CPU No.4 transmitting data (No.1)
CPU No.4 transmitting data (No.2)
CPU No.4 transmitting data (No.3)
CPU No.4 transmitting data (No.4)
Maximum 2k words
Read via END processing of CPU No.1
Setting 1
B0
to
CPU No.1 transmitting data (No.1)
CPU No.2 receiving data (No.1)
CPU No.3 receiving data (No.1)
CPU No.4 receiving data (No.1)
Setting 2
W0
CPU No.1 transmitting data (No.2)
CPU No.2 receiving data (No.2)
CPU No.3 receiving data (No.2)
CPU No.4 receiving data (No.2)
Setting 3
D0
CPU No.1 transmitting data (No.3)
CPU No.2 receiving data (No.3)
CPU No.3 receiving data (No.3)
CPU No.4 receiving data (No.3)
Setting 4
M0
CPU No.1 transmitting data (No.4)
CPU No.2 receiving data (No.4)
CPU No.3 receiving data (No.4)
CPU No.4 receiving data (No.4)
Maximum 8k words
Write during END processing
Write during END processing
Write during END processing
Write during END processing
CPU No.1 transmitting data (No.1)
CPU No.1 transmitting data (No.2)
CPU No.1 transmitting data (No.3)
CPU No.1 transmitting data (No.4)
User-defined area
Maximum 2k words

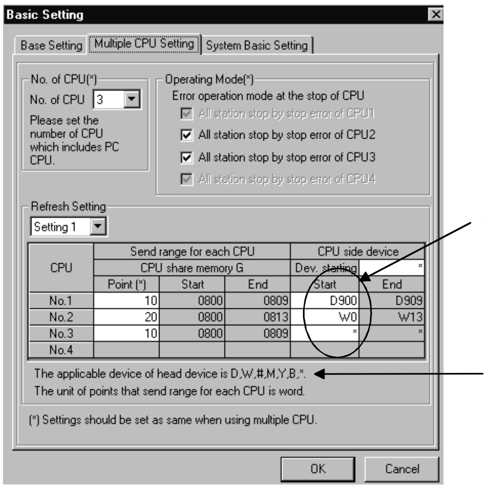
(3) Automatic refresh settings 2 (Manual setting)

Refer to Section "1.3.4(4)" for the applicable version of Motion CPU and the software.

(a) When the automatic refresh setting (Manual setting) of Motion CPU is used, there are the following advantages.

1) A device setting which executes the automatic refresh setting between the PLC CPU and Motion CPU can be performed flexibly.
2) Because it is made not to execute the automatic refresh setting between the Motion CPU using a dummy setting, it is not necessary to use the user device for the automatic refresh vainly, and a main cycle can also be shortened.
3) It is possible to execute the automatic refresh of Motion device (#) to the PLC CPU directly. Similarly, it is possible to execute the automatic refresh for data of the PLC CPU to the Motion device (#) directly.

Refer to the "QCPU User's Manual (Function Explanation/Program Fundamentals)" about the setting for the PLC CPU.



No. of CPU(*)
No. of CPU 3
Please set the number of CPU which includes PC CPU.

Operating Mode(*)
Error operation mode at the stop of CPU
☑ All station stop by stop error of CPU1
☑ All station stop by stop error of CPU2
☑ All station stop by stop error of CPU3
☑ All station stop by stop error of CPU4

Refresh Setting
Setting 1

CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. starting	*
	Point (*)	Start	End	Start	End
No.1	10	0800	0809	D900	D909
No.2	20	0800	0813	W0	W13
No.3	10	0800	0809	*	*
No.4					

The applicable device of head device is D,W,#,M,Y,B,*.
The unit of points that send range for each CPU is word.

(*) Settings should be set as same when using multiple CPU.

- The first device can be arbitrarily set up for every CPU. "DUMMY(*)" can be set to the first device except the self CPU.
- The motion device (#) can be set as a first device.

(b) Setting selection/send range (refresh range) for each CPU

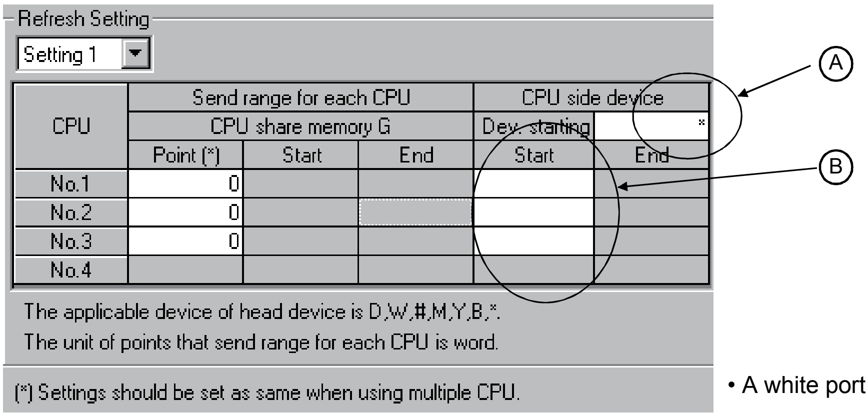
1) The refresh setting of four ranges can be set by setting selection.
For example, ON/OFF data may be refreshed using bit-device setting, while other data may be refreshed word device setting.

2) The number of points in the shared CPU memory is set in units of 2 points (2 words) is set in the send range for each CPU. (2 points if word device is specified for the CPU-side device, or 32 points if bit device is specified.)
Data of the CPU for which "0" is set as the number of points representing the transmitting range of the CPU may not be refreshed.

3) The maximum number of transmitting points combining all four ranges is 2k words per CPU (PLC CPU or Motion CPU) or 8k points (8k words) for all CPUs.

4) If "*" is set as the first device setting column A of each automatic refresh setting, the first device for every CPU can be arbitrarily set up by the user in the column of B.

5) "DUMMY" setting can be set to the first device column B of the automatic refresh setting. ("DUMMY" setting cannot be set to the self CPU.) "DUMMY" setting should set "*" as the first devise column B. The self CPU does not execute the automatic refresh to the other CPU which carried out "DUMMY (*)" setting.



Refresh Setting

Setting 1

CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. starting	*
	Point (*)	Start	End	Start	End
No.1	0				
No.2	0				
No.3	0				
No.4					

The applicable device of head device is D,W,#,M,Y,B,*.
The unit of points that send range for each CPU is word.

(*) Settings should be set as same when using multiple CPU.

• A white portion can be set.

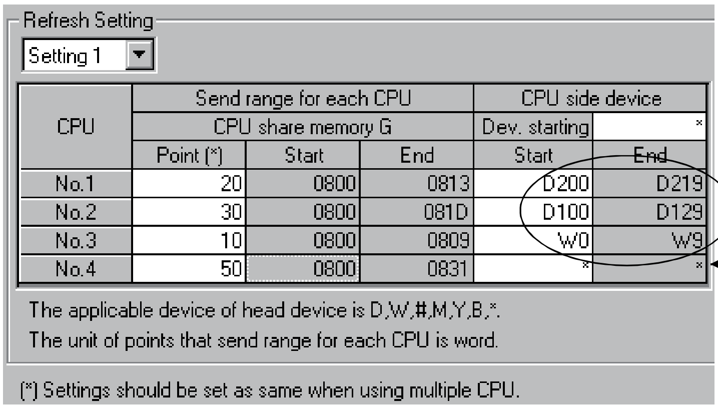
6) Set the same number of transmitting points for all CPUs in the Multiple CPU system.
If any of the CPUs has a different number of transmitting points, a PARAMETER ERROR will be occurred.

(c) CPU-side device

The following devices can be used for automatic refresh. (Other devices cannot be set in SW6RN-GSV□P.)

Settable device	Restriction
Data resister (D) Link resister (W) Motion resister (#)	None
Link relay (B) Internal relay (M) Output (Y)	• Specify 0 or a multiple of 16 as the first No.. • One transmitting point occupies 16 points.

• Self CPU (CPU No.2)
Refresh setting 1



Refresh Setting

Setting 1

CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. starting	*
	Point (*)	Start	End	Start	End
No.1	20	0800	0813	D200	D219
No.2	30	0800	081D	D100	D129
No.3	10	0800	0809	W0	W9
No.4	50	0800	0831	*	*

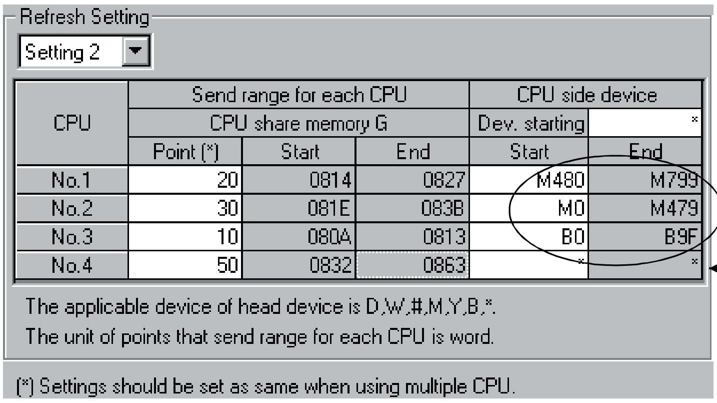
The applicable device of head device is D,W,#,M,Y,B,*.
The unit of points that send range for each CPU is word.

(*) Settings should be set as same when using multiple CPU.

• If the device No. does not overlap, it is right.

• The device of CPU No.4 at setting 1 is not refreshed by the CPU No.2.

• Self CPU (CPU No.2)
Refresh setting 2



Refresh Setting

Setting 2

CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. starting	*
	Point (*)	Start	End	Start	End
No.1	20	0814	0827	M480	M799
No.2	30	081E	083B	M0	M479
No.3	10	080A	0813	B0	B9F
No.4	50	0832	0863	*	*

The applicable device of head device is D,W,#,M,Y,B,*.
The unit of points that send range for each CPU is word.

(*) Settings should be set as same when using multiple CPU.

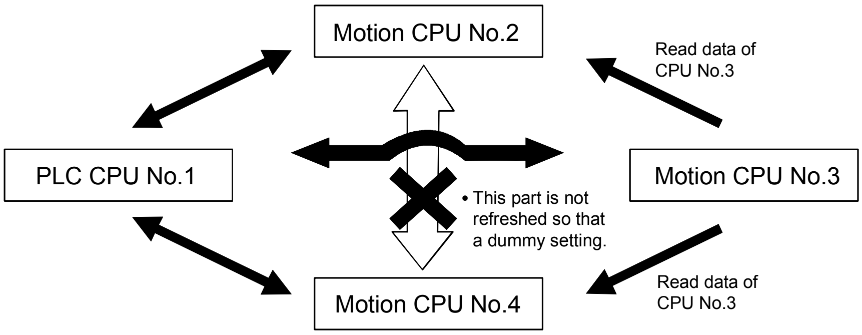
• If the device No. does not overlap, it is right.

• The device of CPU No.4 at setting 2 is not refreshed by the CPU No.2.

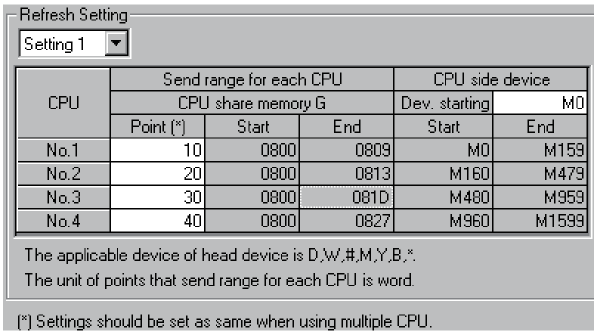
[Dummy setting]

Usually, the automatic refresh setting is executed between PLC CPU and Motion CPU for the instructions to each Motion CPU and the monitor of a state by the PLC CPU at the time of operation. However, the automatic refresh is not necessary between each Motion CPU. In this case, because it is made not to execute the automatic refresh setting between the Motion CPU using a dummy setting, it is not necessary to use the user device for the automatic refresh vainly, and a main cycle can also be shortened.

Example of the automatic refresh setting using the "Dummy setting" is as follows.



• PLC CPU (CPU No.1)
Automatic refresh setting 1



Refresh Setting

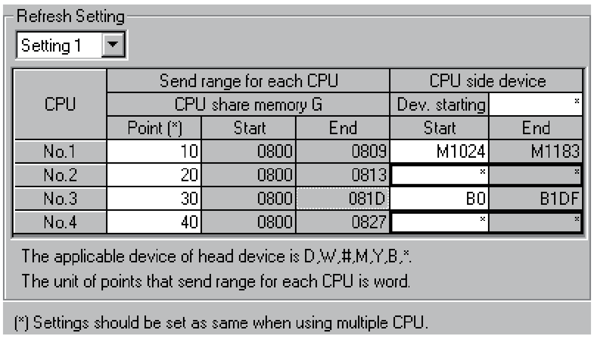
Setting 1

CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. starting	M0
	Point (*)	Start	End	Start	End
No.1	10	0800	0809	M0	M159
No.2	20	0800	0813	M160	M479
No.3	30	0800	081D	M480	M959
No.4	40	0800	0827	M960	M1599

The applicable device of head device is D,W,#,M,Y,B,*.
The unit of points that send range for each CPU is word.

(*) Settings should be set as same when using multiple CPU.

• Motion CPU (CPU No.3)
Automatic refresh setting 1



Refresh Setting

Setting 1

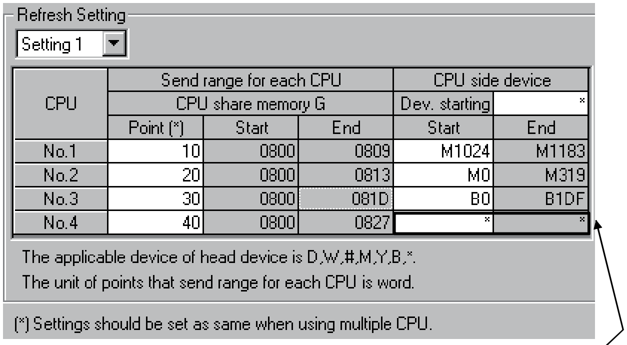
CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. starting	*
	Point (*)	Start	End	Start	End
No.1	10	0800	0809	M1024	M1183
No.2	20	0800	0813	*	*
No.3	30	0800	081D	B0	B1DF
No.4	40	0800	0827	*	*

The applicable device of head device is D,W,#,M,Y,B,*.
The unit of points that send range for each CPU is word.

(*) Settings should be set as same when using multiple CPU.

• The device of CPU No.2 and No.4 are not refreshed by the CPU No.3.

• Motion CPU (CPU No.2)
Automatic refresh setting 1



Refresh Setting

Setting 1

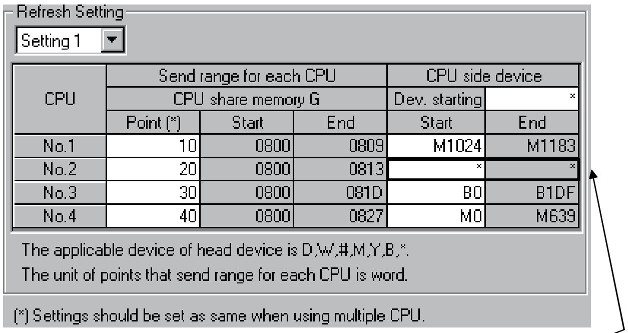
CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. starting	*
	Point (*)	Start	End	Start	End
No.1	10	0800	0809	M1024	M1183
No.2	20	0800	0813	M0	M319
No.3	30	0800	081D	B0	B1DF
No.4	40	0800	0827	*	*

The applicable device of head device is D,W,#,M,Y,B,*.
The unit of points that send range for each CPU is word.

(*) Settings should be set as same when using multiple CPU.

• The device of CPU No.4 is not refreshed by the CPU No.2.

• Motion CPU (CPU No.4)
Automatic refresh setting 1



Refresh Setting

Setting 1

CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. starting	*
	Point (*)	Start	End	Start	End
No.1	10	0800	0809	M1024	M1183
No.2	20	0800	0813	*	*
No.3	30	0800	081D	B0	B1DF
No.4	40	0800	0827	M0	M639

The applicable device of head device is D,W,#,M,Y,B,*.
The unit of points that send range for each CPU is word.

(*) Settings should be set as same when using multiple CPU.

• The device of CPU No.2 is not refreshed by the CPU No.4.

Although the example of a setting is the case of the automatic refresh setting 1, the automatic refresh setting 2 - 4 can be also set similarly.

(4) The layout example of automatic refresh setting

The layout example of automatic refresh when Read/Write does a Motion dedicated device in the Motion CPU with PLC CPU is shown below.

(a) SV13

- Overall configuration

Table of the internal relays

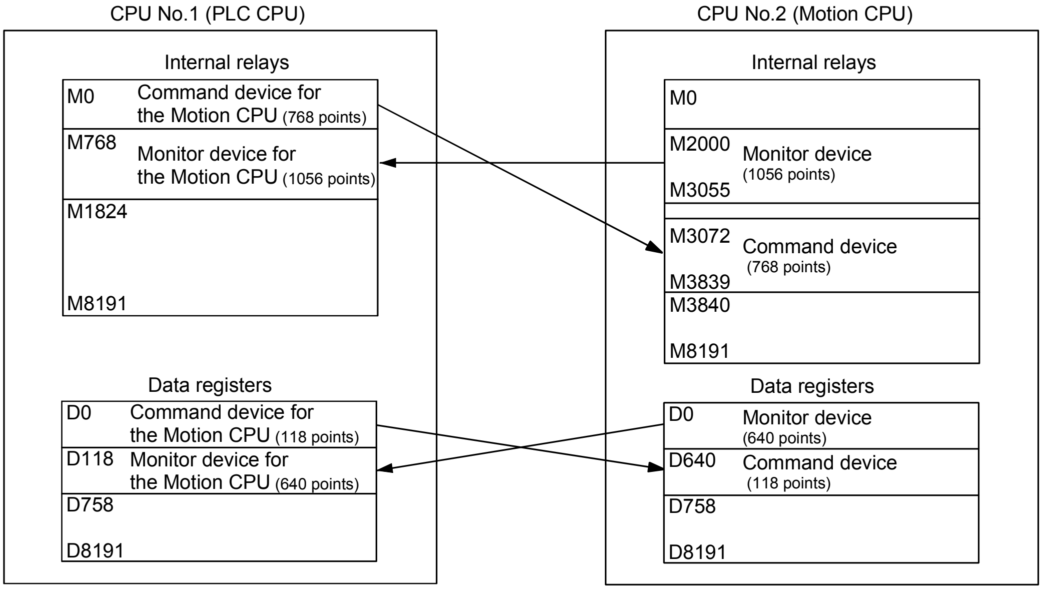
Device No.	Application
M0 to	User device (2000 points)
M2000 to	Common device (320 points)
M2320 to	Special relay allocated device (Status) (80 points)
M2400 to	Axis status (20 points × 32 axes)
M3040 to	Unusable
M3072 to	Common device (Command signal) (64 points)
M3136 to	Special relay allocated device (Command signal) (64 points)
M3200 to	Axis command signal (20 points × 32 axes)
M3840 to M8191	User device (4352 points)

Table of the Data registers

Device No.	Application
D0 to	Axis monitor device (20 points × 32 axes)
D640 to	Control change register (2 points × 32 axes)
D704 to	Common device (Common signal) (54 points)
D758 to	Common device (Monitor) (42 points)
D800 to D8191	User device (7392 points)

1) PLC CPU (1 module) + Motion CPU (1 module)

The outline operation and the automatic refresh setting are as follows.


CPU No.1 (PLC CPU)
Internal relays
M0 Command device for the Motion CPU (768 points)
M768 Monitor device for the Motion CPU (1056 points)
M1824
M8191
Data registers
D0 Command device for the Motion CPU (118 points)
D118 Monitor device for the Motion CPU (640 points)
D758
D8191
CPU No.2 (Motion CPU)
Internal relays
M0
M2000 Monitor device (1056 points)
M3055
M3072 Command device (768 points)
M3839
M3840
M8191
Data registers
D0 Monitor device (640 points)
D640 Command device (118 points)
D758
D8191

- Automatic refresh setting 1

PLC CPU (CPU No.1)

CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. starting	M0
	Point	Start	End	Start	End
No.1	48			M0	M767
No.2	66			M768	M1823
No.3					
No.4					

Motion CPU (CPU No.2)

CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. starting	*
	Point	Start	End	Start	End
No.1	48			M3072	M3839
No.2	66			M2000	M3055
No.3					
No.4					

- Automatic refresh setting 2

PLC CPU (CPU No.1)

CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. starting	D0
	Point	Start	End	Start	End
No.1	118			D0	D117
No.2	640			D118	D757
No.3					
No.4					

Motion CPU (CPU No.2)

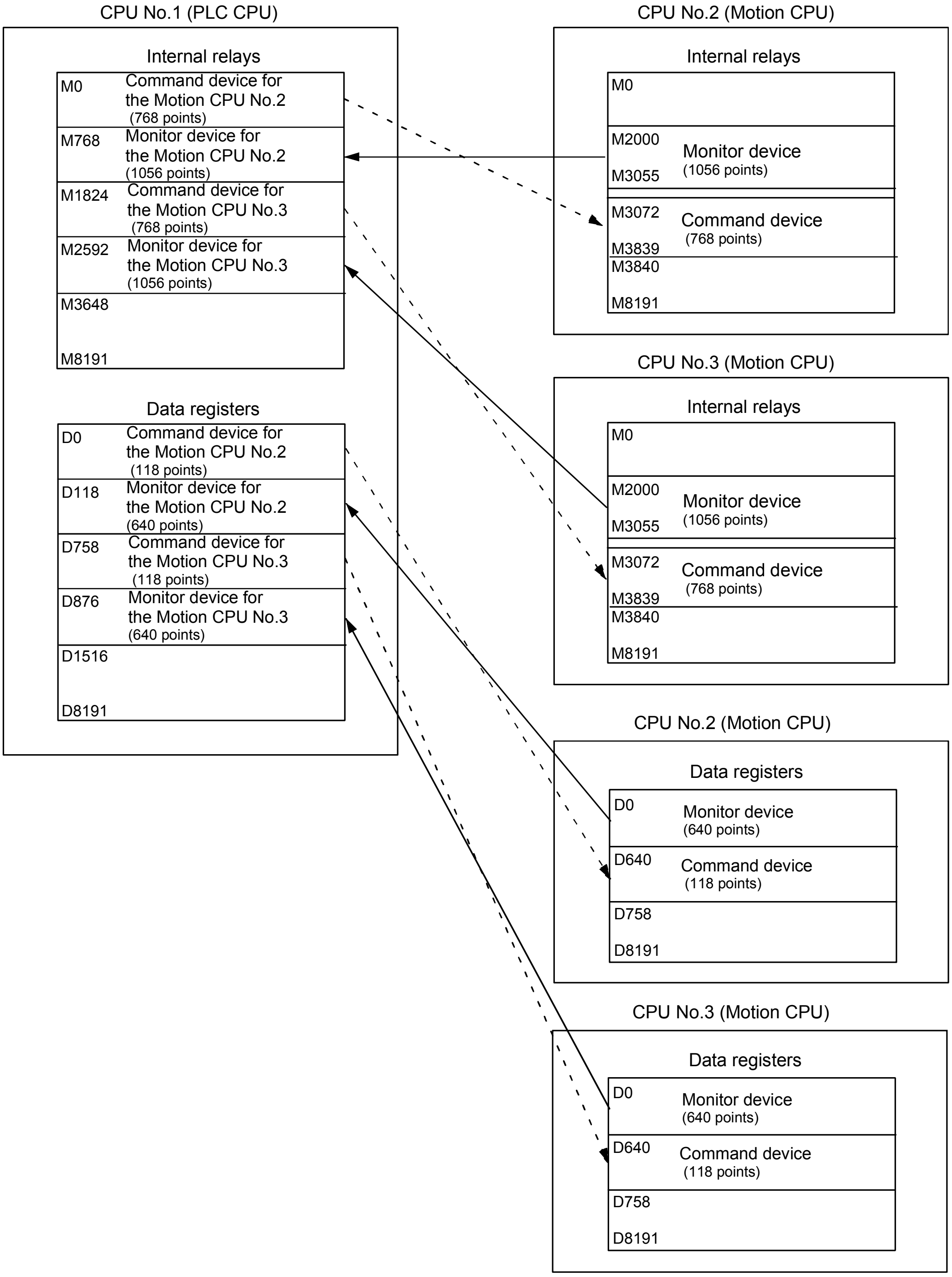
CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. starting	*
	Point	Start	End	Start	End
No.1	118			D640	D757
No.2	640			D0	D639
No.3					
No.4					

POINT

Although it has set up so that 32 axes may be assigned in the above assignment example, reduce the number of assignment automatic refresh points a part for the number of axes to be used.

2) PLC CPU (1 module) + Motion CPU (2 modules)

The outline operation and the automatic refresh setting are shown below.


CPU No.1 (PLC CPU)
Internal relays
M0 Command device for the Motion CPU No.2 (768 points)
M768 Monitor device for the Motion CPU No.2 (1056 points)
M1824 Command device for the Motion CPU No.3 (768 points)
M2592 Monitor device for the Motion CPU No.3 (1056 points)
M3648
M8191
Data registers
D0 Command device for the Motion CPU No.2 (118 points)
D118 Monitor device for the Motion CPU No.2 (640 points)
D758 Command device for the Motion CPU No.3 (118 points)
D876 Monitor device for the Motion CPU No.3 (640 points)
D1516
D8191
CPU No.2 (Motion CPU)
Internal relays
M0
M2000 Monitor device (1056 points)
M3055
M3072 Command device (768 points)
M3839
M3840
M8191
CPU No.3 (Motion CPU)
Internal relays
M0
M2000 Monitor device (1056 points)
M3055
M3072 Command device (768 points)
M3839
M3840
M8191
CPU No.2 (Motion CPU)
Data registers
D0 Monitor device (640 points)
D640 Command device (118 points)
D758
D8191
CPU No.3 (Motion CPU)
Data registers
D0 Monitor device (640 points)
D640 Command device (118 points)
D758
D8191

- Automatic refresh setting 1

PLC CPU (CPU No.1)

CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. starting	M0
	Point	Start	End	Start	End
No.1	48			M0	M767
No.2	66			M768	M1823
No.3	0				
No.4					

Motion CPU (CPU No.2)

CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. starting	*
	Point	Start	End	Start	End
No.1	48			M3072	M3839
No.2	66			M2000	M3055
No.3	0				
No.4					

- Automatic refresh setting 2

PLC CPU (CPU No.1)

CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. Starting	D0
	Point	Start	End	Start	End
No.1	118			D0	D117
No.2	640			D118	D757
No.3	0				
No.4					

Motion CPU (CPU No.2)

CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. starting	*
	Point	Start	End	Start	End
No.1	118			D640	D757
No.2	640			D0	D639
No.3	0				
No.4					

- Automatic refresh setting 3

PLC CPU (CPU No.1)

CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. Starting	M1824
	Point	Start	End	Start	End
No.1	48			M1824	M2591
No.2	0				
No.3	66			M2592	M3647
No.4					

Motion CPU (CPU No.2)

CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. starting	*
	Point	Start	End	Start	End
No.1	48			*	*
No.2	0				
No.3	66			*	*
No.4					

(Note) : A dummy setting is made so that an excessive device may not be refreshed in the Motion CPU No.2.

- Automatic refresh setting 4

PLC CPU (CPU No.1)

CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. starting	D758
	Point	Start	End	Start	End
No.1	118			D758	D875
No.2	0				
No.3	640			D876	D1515
No.4					

Motion CPU (CPU No.2)

CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. starting	*
	Point	Start	End	Start	End
No.1	118			*	*
No.2	0				
No.3	640			*	*
No.4					

(Note) : A dummy setting is made so that an excessive device may not be refreshed in the Motion CPU No.2.

- Automatic refresh setting 1

Motion CPU (CPU No.3)

CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. starting	*
	Point	Start	End	Start	End
No.1	48			*	*
No.2	66			*	*
No.3	0				
No.4					

(Note) : A dummy setting is made so that an excessive device may not be refreshed in the Motion CPU No.3.

- Automatic refresh setting 2

Motion CPU (CPU No.3)

CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. starting	*
	Point	Start	End	Start	End
No.1	118			*	*
No.2	640			*	*
No.3	0				
No.4					

(Note) : A dummy setting is made so that an excessive device may not be refreshed in the Motion CPU No.3.

- Automatic refresh setting 3

Motion CPU (CPU No.3)

CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. starting	*
	Point	Start	End	Start	End
No.1	48			M3072	M3839
No.2	0				
No.3	66			M2000	M3055
No.4					

- Automatic refresh setting 4

Motion CPU (CPU No.3)

CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. starting	*
	Point	Start	End	Start	End
No.1	118			D640	D757
No.2	0				
No.3	640			D0	D639
No.4					

POINT

In the case of the combination "PLC CPU (1 module) + Motion CPU (3 modules)" with SV13, make all the devices of all the CPUs refresh as mentioned above because the setting that Read/Write is made of the PLC CPU cannot be executed.

(b) SV22

- Overall configuration

Table of the internal relays

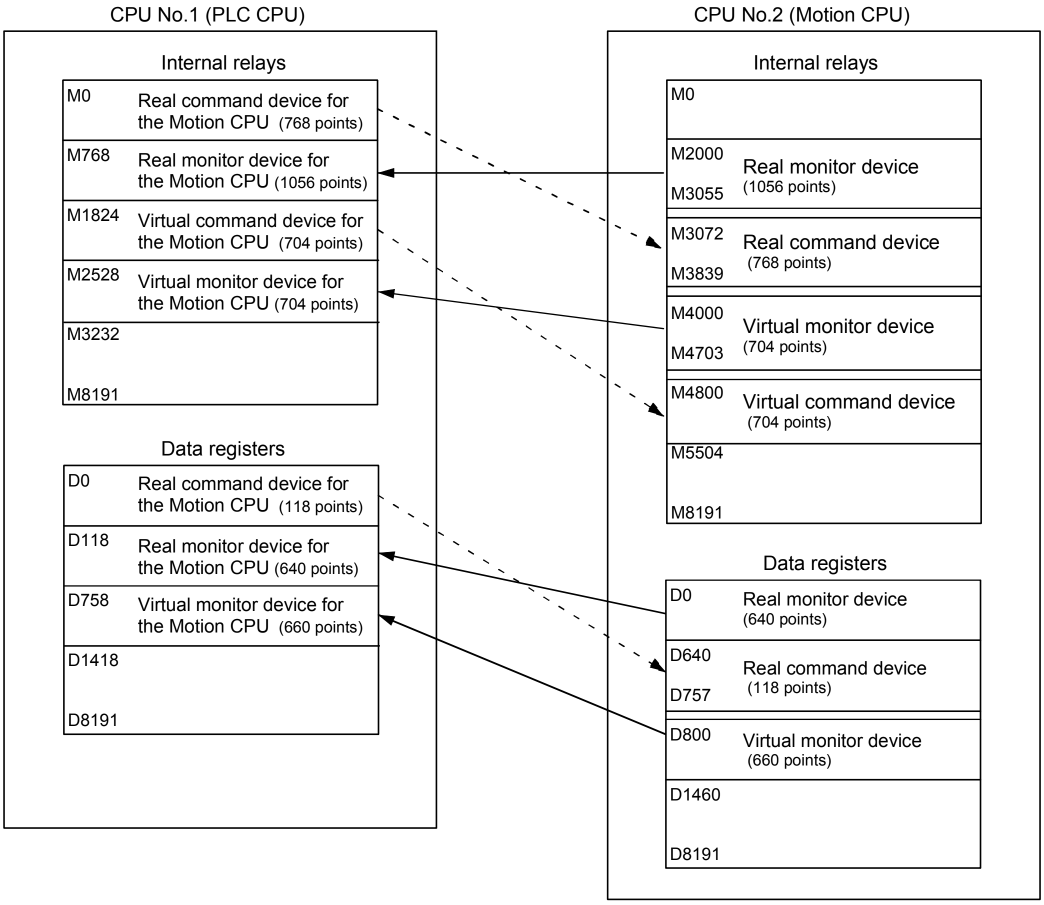
Device No.	Application
M0 to	User device (2000 points)
M2000 to	Common device (320 points)
M2320 to	Special relay allocated device (Status) (64 points)
M2400 to	Axis status (20 points × 32 axes)
M3040 to	Unusable
M3072 to	Common device (Command signal) (64 points)
M3136 to	Special relay allocated device (Command signal) (64 points)
M3200 to	Axis command signal (20 points × 32 axes)
M3840 to	Unusable
M4000 to	Virtual servomotor axis status (20 points × 32 axes) (Mechanical system setting axis only)
M4640 to	Synchronous encoder axis status (4 points × 12 axes)
M4688 to	Unusable
M4800 to	Virtual servomotor axis command signal (20 points × 32 axes) (Mechanical system setting axis only)
M5440 to	Synchronous encoder axis command signal (4 points × 12 axes)
M5488 to	Cam axis command signal (1 points × 32 axes) (Mechanical system setting axis only)
M5520 to	Soothing clutch complete signal (2 points × 32 axes)
M5584 to	Unusable
M5600 to M8191	User device) (2592 points)

Table of the Data registers

Device No.	Application
D0 to	Axis monitor device (20 points × 32 axes)
D640 to	Control change register (2 points × 32 axes)
D704 to	Common device (Command signal) (54 points)
D758 to	Common device (Monitor) (42 points)
D800 to	Virtual servomotor axis monitor device (10 points × 32 axes) (Mechanical system setting axis only)
D1120 to	Synchronous encoder axis monitor device (10 points × 12 axes)
D1240 to	Cam axis monitor device (10 points × 32 axes)
D1560 to D8191	User device (6632 points)

1) PLC CPU (1 module) + Motion CPU (1 module)

The outline operation and the automatic refresh setting are as follows.


CPU No.1 (PLC CPU)
Internal relays
M0
Real command device for the Motion CPU (768 points)
M768
Real monitor device for the Motion CPU (1056 points)
M1824
Virtual command device for the Motion CPU (704 points)
M2528
Virtual monitor device for the Motion CPU (704 points)
M3232
M8191
Data registers
D0
Real command device for the Motion CPU (118 points)
D118
Real monitor device for the Motion CPU (640 points)
D758
Virtual monitor device for the Motion CPU (660 points)
D1418
D8191
CPU No.2 (Motion CPU)
Internal relays
M0
M2000
Real monitor device (1056 points)
M3055
M3072
Real command device (768 points)
M3839
M4000
Virtual monitor device (704 points)
M4703
M4800
Virtual command device (704 points)
M5504
M8191
Data registers
D0
Real monitor device (640 points)
D640
Real command device (118 points)
D757
D800
Virtual monitor device (660 points)
D1460
D8191

• Automatic refresh setting 1

PLC CPU (CPU No.1)

CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. starting	M0
	Point	Start	End	Start	End
No.1	48			M0	M767
No.2	66			M768	M1823
No.3					
No.4					

Motion CPU (CPU No.2)

CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. starting	*
	Point	Start	End	Start	End
No.1	48			M3072	M3839
No.2	66			M2000	M3055
No.3					
No.4					

• Automatic refresh setting 2

PLC CPU (CPU No.1)

CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. Starting	D0
	Point	Start	End	Start	End
No.1	118			D0	D117
No.2	640			D118	D757
No.3					
No.4					

Motion CPU (CPU No.2)

CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. starting	*
	Point	Start	End	Start	End
No.1	118			D640	D757
No.2	640			D0	D639
No.3					
No.4					

• Automatic refresh setting 3

PLC CPU (CPU No.1)

CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. Starting	M1824
	Point	Start	End	Start	End
No.1	44			M1824	M2527
No.2	44			M2528	M3231
No.3					
No.4					

Motion CPU (CPU No.2)

CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. starting	*
	Point	Start	End	Start	End
No.1	44			M4800	M5503
No.2	44			M4000	M4703
No.3					
No.4					

• Automatic refresh setting 4

PLC CPU (CPU No.1)

CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. starting	D758
	Point	Start	End	Start	End
No.1	0				
No.2	660			D758	D1417
No.3					
No.4					

Motion CPU (CPU No.2)

CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. starting	*
	Point	Start	End	Start	End
No.1	0				
No.2	660			D800	D1459
No.3					
No.4					

POINT

In the case of the combination "PLC CPU (1 module) + Motion CPU (2 modules)" with SV22, make all the devices of all the CPUs refresh as mentioned above because the setting that Read/Write is made of the PLC CPU cannot be executed.

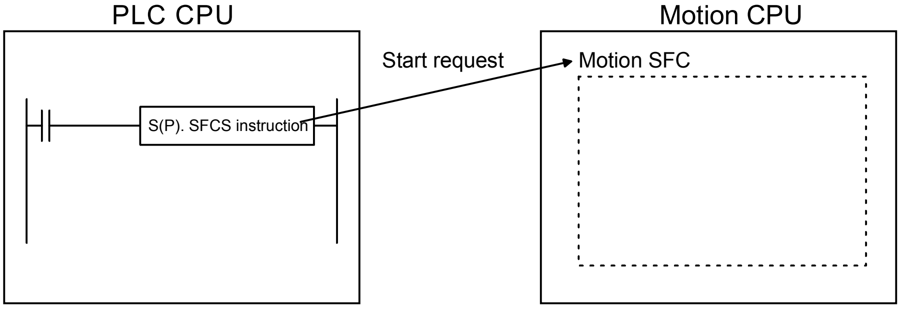
3.2 Control Instruction from the PLC CPU to The Motion CPU (Motion dedicated instructions)

Control can be instructed from the PLC CPU to the Motion CPU using the Motion dedicated PLC instructions listed in the table below.
Refer to Chapter "5 MOTION DEDICATED PLC INSTRUCTIONS" for the details of each instruction.
(Control may not be instructed from the Motion CPU to another Motion CPU.)

Instruction name	Description
S(P).SFCS	Start request of the Motion SFC program (Program No. may be specified.)
S(P).SVST	Start request of the specified servo program
S(P).CHGA	Current value change request of the specified axis
S(P).CHGV	Speed change request of the specified axis
S(P).CHGT	Torque control value change request of the specified axis
S(P).GINT	Execute request of an event task to the other CPU (Motion CPU)

By using the S(P). SFCS instruction of the Motion dedicated instruction, the Motion SFC of the Motion CPU from the PLC CPU can be started.

<Example>



POINT

One PLC CPU can execute a total of up to 32 "Motion dedicated instructions" and "dedicated instructions excluding the S(P). GINT" simultaneously.
When Motion dedicated instructions and dedicated instructions excluding the "S(P). GINT" are executed simultaneously, the instructions will be processed in the order received.
If the command which has not completed processing becomes 33 or more, an OPERATION ERROR (error code: 4107) will be occurred.

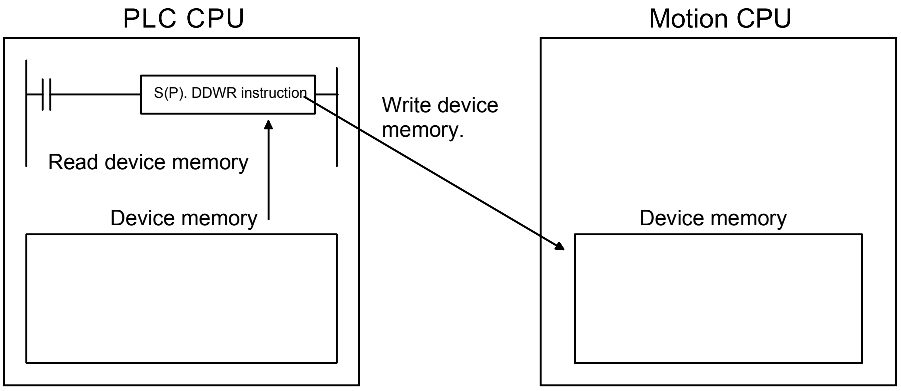
3.3 Reading/Writing Device Data

Device data can be written or read to/from the Motion CPU by the PLC CPU using the dedicated instructions listed in the table below.
Refer to Chapter 5 "MOTION DEDICATED PLC INSTRUCTIONS" for the details of each instruction.
(Data cannot be written or read to/from the PLC CPU by another PLC CPU, to/from the PLC CPU by the Motion CPU, or to/from a Motion CPU by another Motion CPU.)

Instruction name	Description
S(P).DDWR	Write a device data of the self CPU (PLC CPU) to a device of the other CPU (Motion CPU).
S(P).DDRD	Read a device data of other CPU (Motion CPU) to a device of the self CPU (PLC CPU).

For example, by using the S(P). DDWR dedicated instruction, the device data of the PLC CPU can be written to the device data of the Motion CPU.

<Example>



POINT

(1) One PLC CPU can execute a total of up to 32 "Motion dedicated instructions" and "dedicated instructions excluding the S(P). GINT" simultaneously.
When Motion dedicated instructions and dedicated instructions excluding the S(P). GINT are executed simultaneously, the instructions will be processed in the order received.
If the command which has not completed processing becomes 33 or more, an OPERATION ERROR (error code: 4107) will be occurred.

(2) Data refresh via the S(P). DDRD/S(P). DDWR is not synchronized with data refresh via the automatic refresh function of shared CPU memory.
Do not issue S(P). DDRD/S(P). DDWR instructions to the devices whose data in shared CPU memory is being refreshed.

3.4 Shared CPU Memory

Shared CPU memory is used to transfer data between the CPUs in the Multiple CPU system and has a capacity of 4096 words from 0H to FFFH.

Shared CPU memory has four areas: "self CPU operation data area", "system area", "automatic refresh area" and "user-defined area."
When the automatic refresh function of shared CPU memory is set, the area corresponding to the number of automatic refresh points starting from 800H is used as the automatic refresh area.
The user-defined area begins from the address immediately next to the last address of the automatic refresh area.
If the number of automatic refresh points is 18 (12H points), the area from 800H to 811H becomes the automatic refresh area and the area after 812H becomes the user-defined area.
The diagram below shows the structure of shared CPU memory and accessibility from a PLC program.

		Self CPU		Other CPU	
	Shared CPU memory	Write (Note-1)	Read	Write	Read (Note-2)
0H to 1FFH	Self CPU operation data area	Not allowed	Not allowed	Not allowed	Allowed
200H to 7FFH	System area	Not allowed	Not allowed	Not allowed	Allowed
800H to FFFH	Automatic refresh area	Not allowed	Not allowed	Not allowed	Not allowed
	User-defined area	Allowed	Not allowed	Not allowed	Allowed

REMARK

(Note-1) : Use the S. TO instruction to write to the user-defined area of the self CPU in the PLC CPU.
Use the MULTW instruction to write to the user-defined area of the self CPU in the PLC CPU. (Refer to Section 1.3.4(4) for the conditions which can use the MULTW instruction.)

(Note-2) : Use the FROM instruction/intelligent function module device (U□\G□) to read the shared memory of the Motion CPU from the PLC CPU.
Use the MULTR instruction to read the shared memory of other CPU in the Motion CPU. (Refer to Section 1.3.4(4) for the conditions which can use the MULTR instruction.)

(1) Self CPU operation data area (0H to 1FFH)

(a) The following data of the self CPU are stored in the Multiple CPU system,

Table 3.1 Table of Contents Stored in the Self CPU Operation Data Area

Shared memory address	Name	Description	Detailed explanation (Note)	Corresponding special resister
0H	Data available/not available	"Data available/not available" flag	This area is used to check whether data is stored or not in the self CPU operation data area (1H to 1FH) of the self CPU. • 0: Data is not stored in the self CPU operation data area. • 1: Data is stored in the self CPU operation data area.	—
1H	Diagnosis error	Diagnosis error number	The error number of an error generated during diagnosis is stored as a BIN code.	D9008
2H	Diagnosis-error occurrence time	Diagnosis-error occurrence time	The year and month when the error number was stored in address 1H of shared CPU memory is stored in 2-digit BCD code.	D9010
3H			The date and hour when the error number was stored in address 1H of shared CPU memory is stored in 2-digit BCD code.	D9011
4H			The minutes and seconds when the error number was stored in address 1H of shared CPU memory is stored in 2-digit BCD code.	D9012
5H	Error-data category code	Error-data category code	Category codes indicating the nature of the stored common error data and individual error data are stored.	D9013
6H	Error data	Error data	Common data corresponding to the error number of an error generated during diagnosis is stored.	D9014
7H to 1CH	Not used	—	Not used	—
1DH	Switch status	CPU switch status	The switch status of the CPU is stored.	D9200
1EH	LED status	CPU-LED status	The bit pattern of the CPU LED is stored	D9201
1FH	CPU operation status	CPU operation status	The operation status of the CPU is stored.	D9015

(Note) : Refer to the applicable special register for details.

(b) The self CPU operation data area is refreshed every time the applicable register has been changed.
However, the refresh timing may be delayed by up to the main cycle time.
(It updates using idle time during motion control. The maximum main cycle time: several milliseconds to several hundred milliseconds).

(c) The data of the self CPU operation data area can be read from the PLC CPU of the other CPU by the FROM instruction.
However, since there is a delay in data update, use the data that has been read as an object for monitoring only.

(d) Self CPU operation data area used by Motion dedicated PLC instruction (30H to 33H)
The complete status of the to self CPU high speed interrupt accept flag from CPUn is stored in the following address.

Table 3.2 Self CPU Operation Data Area used by the Motion Dedicated PLC Instruction

Shared memory address	Name	Description
30H(48)	To self CPU high speed interrupt accept flag from CPU1	This area is used to check whether to self CPU high speed interrupt accept flag from CPUn can be accepted or not. 0: To self CPU high speed interrupt accept flag from CPUn accept usable. 1: To self CPU high speed interrupt accept flag from CPUn accept disable.
31H(49)	To self CPU high speed interrupt accept flag from CPU2	
32H(50)	To self CPU high speed interrupt accept flag from CPU3	
33H(51)	To self CPU high speed interrupt accept flag from CPU4	

(2) System area (204H to 20DH)

This area is used by the operating systems (OS) of the PLC CPU/Motion CPU. OS uses this area when executing dedicated Multiple CPU communication instructions.

- System area used by Motion dedicated PLC instruction (204H to 20DH)
  The complete status is stored in the following.

Table 3.3 Table of System Area used by the Motion Dedicated PLC Instruction

Shared memory address	Name	Description
204H(516)	Start accept flag (Axis1 to 16)	The start accept flag is stored by the 1 to 32 axis, each bit. (As for a bit's actually being set Q173CPU(N) : J1 to J32/ Q172CPU(N) : J1 to J8.) OFF : Start accept flag usable ON : Start accept flag disable b15 b1 b0 204H(516) address J16 •••••••• J2 J1 205H(517) address J32 •••••••• J17
205H(517)	Start accept flag (Axis17 to 32)	
206H(518)	Speed changing flag (Axis1 to 16)	The speed changing flag is stored by the 1 to 32 axis, each bit. (As for a bit's actually being set Q173CPU(N) : J1 to J32/ Q172CPU(N) : J1 to J8.) OFF : Start accept usable ON : Start accept disable b15 b1 b0 206H(518) address J16 •••••••• J2 J1 207H(519) address J32 •••••••• J17
207H(519)	Speed changing flag (Axis17 to 32)	
208H(520)	Synchronous encoder current value changing flag (Axis1 to 12) (Note-1)	The synchronous encoder current value change flag is stored by the 1 to 16 axis, each bit. (As for a bit's actually being set Q173CPU(N) : E1 to E12/ Q172CPU(N) : E1 to E8.) OFF : Start accept usable ON : Start accept disable b15 b1 b0 208H(520) address E16 •••••••• E2 E1
20CH(524)	Cam shaft within-one-revolution current value changing flag (Axis1 to 16) (Note-1)	The cam shaft within-one-revolution current value changing flag is stored by the 1 to 32 axis, each bit. (As for a bit's actually being set Q173CPU(N) : C1 to C32/ Q172CPU(N) : C1 to C8.) OFF : Start accept usable ON : Start accept disable b15 b1 b0 20CH(524) address C16 •••••••• C2 C1 20DH(525) address C32 •••••••• C17
20DH(525)	Cam shaft within-one-revolution current value changing flag (Axis17 to 32) (Note-1)	

(Note-1) : Usable in SV22.

(3) Automatic refresh area

This area is used at the automatic refresh of the Multiple CPU system.
This area cannot be written using S. TO instruction/read using FROM instruction of the PLC CPU and written using MULTW instruction/read using MULTR instruction of the Motion CPU.

(4) User-defined area

This area is used for the communication among each CPU in the Multiple CPU system using FROM/S. TO instructions and the intelligent function module devices of the PLC CPU. (Among each CPU communicates using MULTR instruction or MULTW instruction of the operating control program in the Motion CPU.)
Refer to the Section 7.13.6 to 7.13.7, for MULTR instruction or MULTW instruction.
After point set in the automatic refresh area is used.
(If the automatic refresh function is not executed, the area from 800H to FFFH can be used as a user-defined area.)

MEMO

4. STRUCTURE OF THE MOTION CPU PROGRAM

Motion CPU programs is created in the Motion SFC of flowchart format. The motion control of servomotors is performed using the real-mode servo programs specified by motion-control steps in a Motion SFC program in SV13/SV22 real mode. Virtual servomotors in a mechanical system program are controlled using the virtual mode servo programs specified by motion-control steps so as to enable synchronous control in SV22 virtual mode. Refer to the documents below for the details of Motion SFC programs, motion control in real mode, and motion control in virtual mode.

Item	Reference manual
Motion SFC program	Section 6 in this manual
Motion control in SV13/SV22 real mode (Servo program)	Q173CPU(N)/Q172CPU(N) Motion controller (SV13/SV22) Programming Manual (REAL MODE)
Motion control in SV22 virtual mode (Mechanical system program)	Q173CPU(N)/Q172CPU(N) Motion controller (SV22) Programming Manual (VIRTUAL MODE)

4.1 Motion Control in SV13/SV22 Real Mode

(1) System with servomotor is controlled directly using the servo program in (SV13/SV22) real mode.

(2) Setting of the positioning parameter and creation of the servo program/ Motion SFC program are required.

(3) The procedure of positioning control is shown below:

1) Motion SFC program is requested to start using the S(P).SFCS instruction of the PLC program.
(Motion SFC program can also be started automatically by parameter setting.)

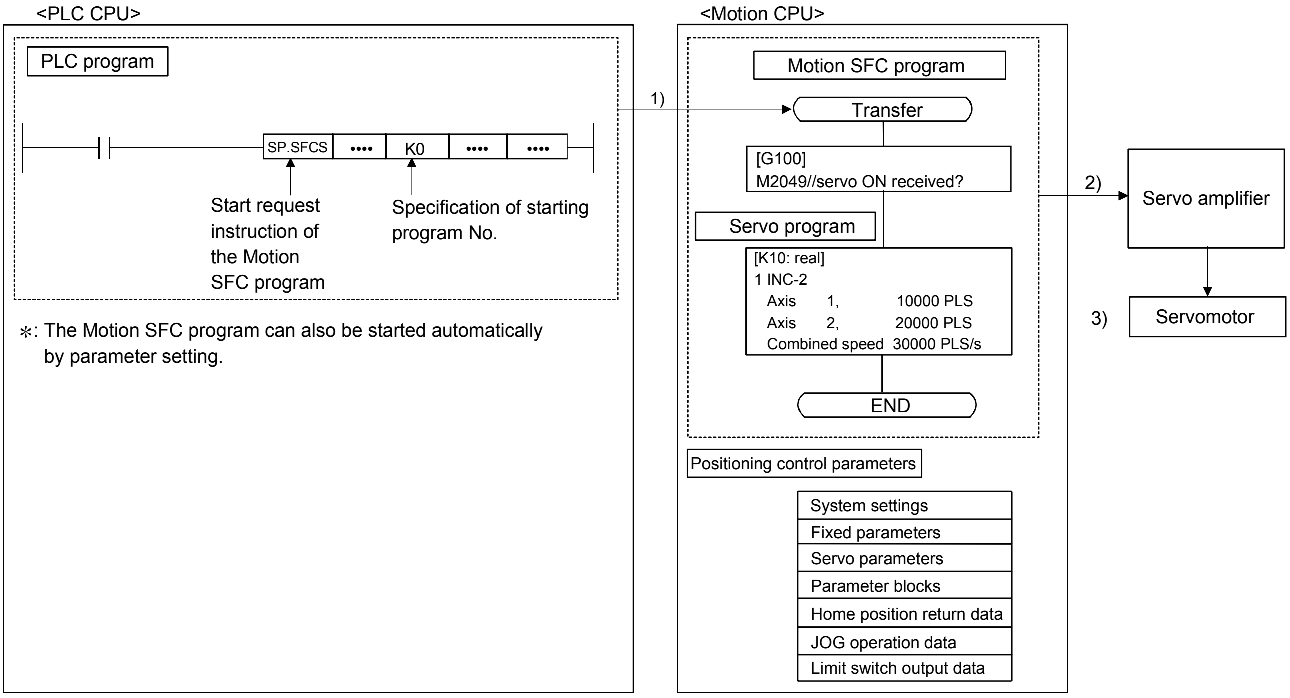
↓

2) Execute the positioning control using the specified the Motion SFC program. (Output to the servo amplifier)

↓

3) The servomotor is controlled.

Program structure in SV13/SV22 real mode



4.2 Motion Control in SV22 Virtual Mode

(1) Software-based synchronous control is performed using the mechanical system program constructed by virtual main shaft and mechanical module in (SV22) virtual mode.

(2) Mechanical system programs is required in addition to the positioning parameter, servo program/Motion SFC program used in real mode.

(3) The procedure of positioning control in virtual model is shown below:

1) Motion SFC program for virtual mode is requested to start using the S(P).SFCS instruction of the PLC program. (Motion SFC program can also be started automatically by parameter setting.)

↓

2) The virtual servomotor in the mechanical system program is started.

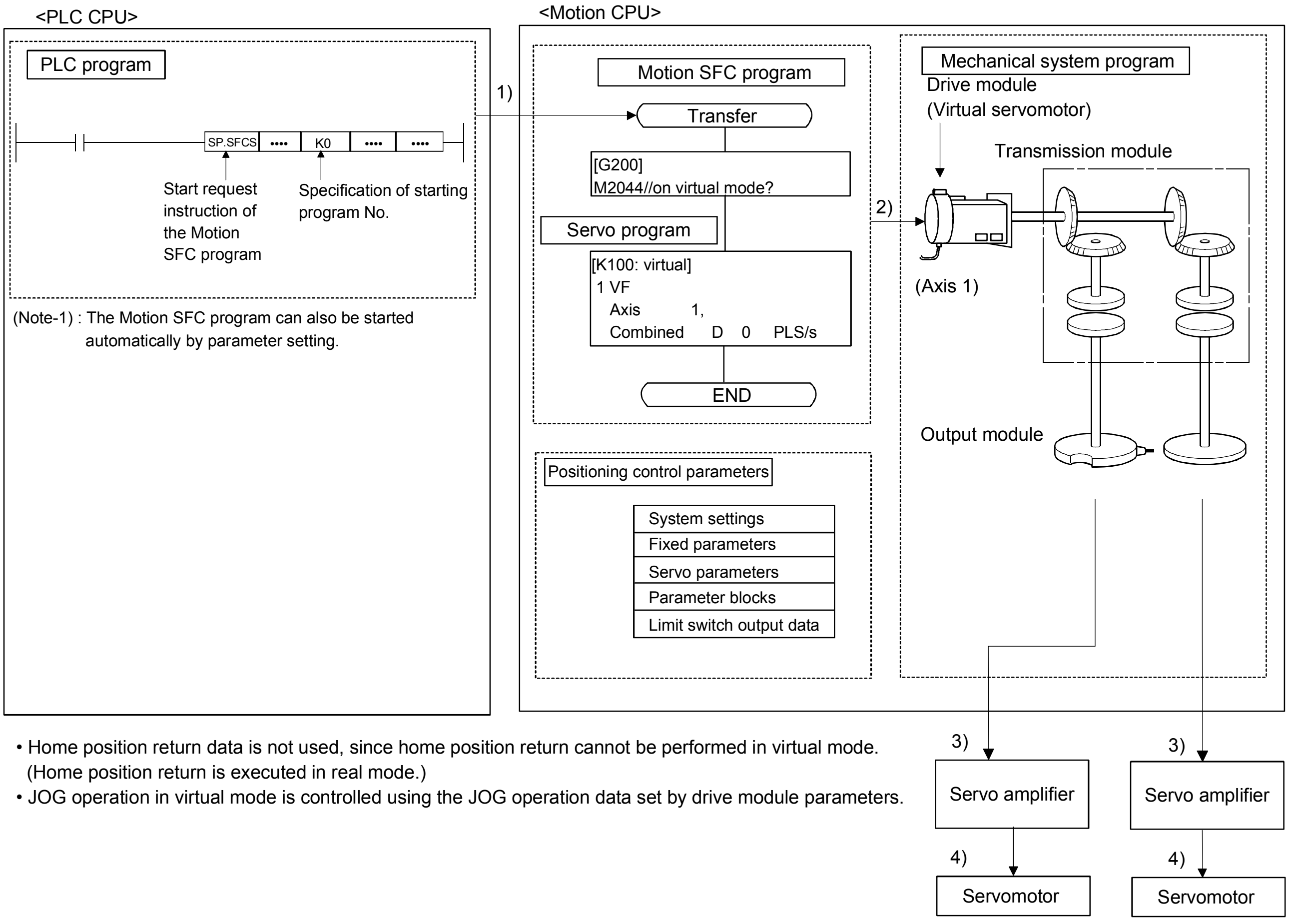
↓

3) Output the operation result obtained through the transmission module to the servo amplifier set as the output module.

↓

4) The servomotor is controlled.

Program structure in SV22 virtual mode



```
[G200]
M2044//on virtual mode?
```

```
[K100: virtual]
1 VF
  Axis        1,
  Combined    D   0    PLS/s
```

- Home position return data is not used, since home position return cannot be performed in virtual mode. (Home position return is executed in real mode.)
- JOG operation in virtual mode is controlled using the JOG operation data set by drive module parameters.

MEMO

5. MOTION DEDICATED PLC INSTRUCTION

5.1 Motion Dedicated PLC Instruction

(1) The Motion dedicated PLC instruction which can be executed toward the Motion CPU which installed a SV13/SV22 operating system software for the Motion SFC is shown below.

Instruction	Description
S(P).SFCS	Start request of the Motion SFC program(Program No. may be specified.)
S(P).SVST	Start request of the specified servo program
S(P).CHGA	Current value change request of the specified axis
S(P).CHGV	Speed change request of the specified axis
S(P).CHGT	Torque control value change request of the specified axis
S(P).DDWR	Write from the PLC CPU to the Motion CPU
S(P).DDRD	Reads from the devices of the Motion CPU
S(P).GINT	Execute request of an event task of Motion SFC program

(Note) : As for the details of each instruction, it explains after the next section.

5.1.1 Restriction item of the Motion dedicated PLC instruction

(1) To self CPU high speed interrupt accept flag from CPUn.
Common precautions of the Motion dedicated PLC instruction as shown below.

(a) To self CPU high speed interrupt accept flag from CPUn is shown in the following table.
To self CPU high speed interrupt accept flag from CPUn is "No operation" even if the instruction is executed when it is cannot be accepted.
When the Motion dedicated PLC instruction is accepted in the Motion CPU, to self CPU high speed interrupt accept flag from CPUn of the self CPU (Motion CPU) shared CPU memory cannot be accepted and processing toward the instruction for requirement.
When processing is completed and it becomes the condition that it has an instruction accepted, to self CPU high speed interrupt accept flag from CPUn can be accepted.

Shared CPU memory address ( ) is decimal address	Description	Example of the reading (When target is the CPU No.2)
30H(48)	The lowest rank bit (30H(48)) toward executing instruction from CPU No.1.	U3E1/G48.0
31H(49)	The lowest rank bit (31H(49)) toward executing instruction from CPU No.2.	U3E1/G49.0
32H(50)	The lowest rank bit (32H(50)) toward executing instruction from CPU No.3.	U3E1/G50.0
33H(51)	The lowest rank bit (33H(51)) toward executing instruction from CPU No.4.	U3E1/G51.0

(b) "To self CPU high speed interrupt accept flag from CPUn" turn ON/OFF at the executing instruction, when the Multiple CPU dedicated instructions are executed to the same CPU from one PLC CPU.
Therefore, when each instruction is executed only once at approval the executing condition, it is necessary to take an interlock by internal relay (M10) and so on besides "To self CPU high speed interrupt accept flag from CPUn".

(2) Execution of the Motion dedicated PLC instruction

(a) Motion dedicated PLC instruction can be executed with fixed cycle execute type PLC and interrupt PLC. However, as for a complete device, the program turned on according to fixed cycle executed type PLC and program type (scan or low speed) executed interrupt PLC is different.

(b) One Motion CPU can be accepted max.32 instructions simultaneously from multiple other CPUs. (Except S(P).GINT instruction.) If 33 instructions or more are executed Motion CPU returns the complete status[4C08] error.
As Motion CPU can be accepted up to 32 instructions, number of acceptable instructions changes according to number of CPUs included Motion CPU. Calculation expression is shown below.

(Number of maximum acceptable instructions per one Motion CPU) =
32 – ((Number of all CPUs) – 2) [Number of instructions]

(c) Local devices and file registers as program are written to device by END processing. Do not use the devices below.

- Each instruction complete device
- D1 of S(P).DDRD instruction (The first device of the self CPU which stored the reading data.)

(d) Use a flag in the shared CPU memory which correspond with each instruction not to execute multiple instructions to the same shaft of the Motion CPU of same CPU No. for the inter-lock condition.
(Program example 1)

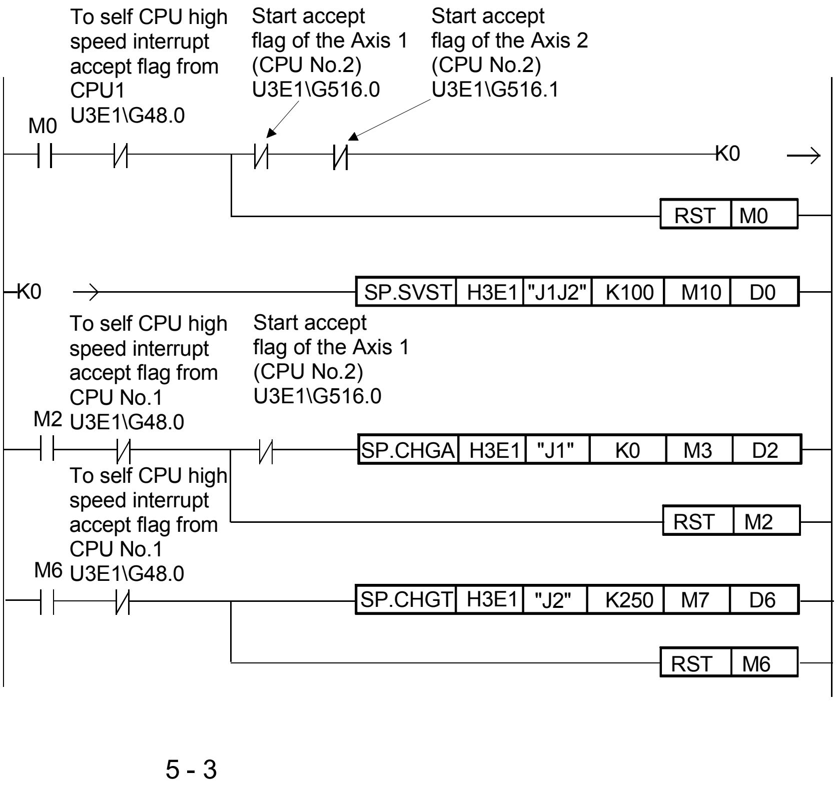
(e) S(P).SFCS/S(P).SVST/S(P).CHGA/S(P).CHGVS(P).CHGT/S(P).DDWR/ S(P).DDRD instructions cannot be executed simultaneously. Therefore, it is necessary to take an interlock by to self CPU high speed interrupt accept flag from CPUn.
One PLC CPU can be executed max.32 Motion dedicated PLC instructions simultaneously using to self CPU high speed interrupt accept flag from CPUn. (Except S(P).GINT instruction.)
If 33 instructions or more are executed, the PLC CPU returns the OPERATION ERROR [4107].

(f) When multiple Motion dedicated PLC instructions are directly executed because one contact-point turns on, an instruction may not be executed.
In this case, create a program with reference to program example.
(Program example 2)

(g) When the Motion dedicated function of the operation control step (Fn/FSn) and Motion control program (Kn) in Motion CPU. Since there is no flag which can be distinguished on instruction execution in the PLC CPU, it is necessary to taken an interlock by user program.
(Program example 3)

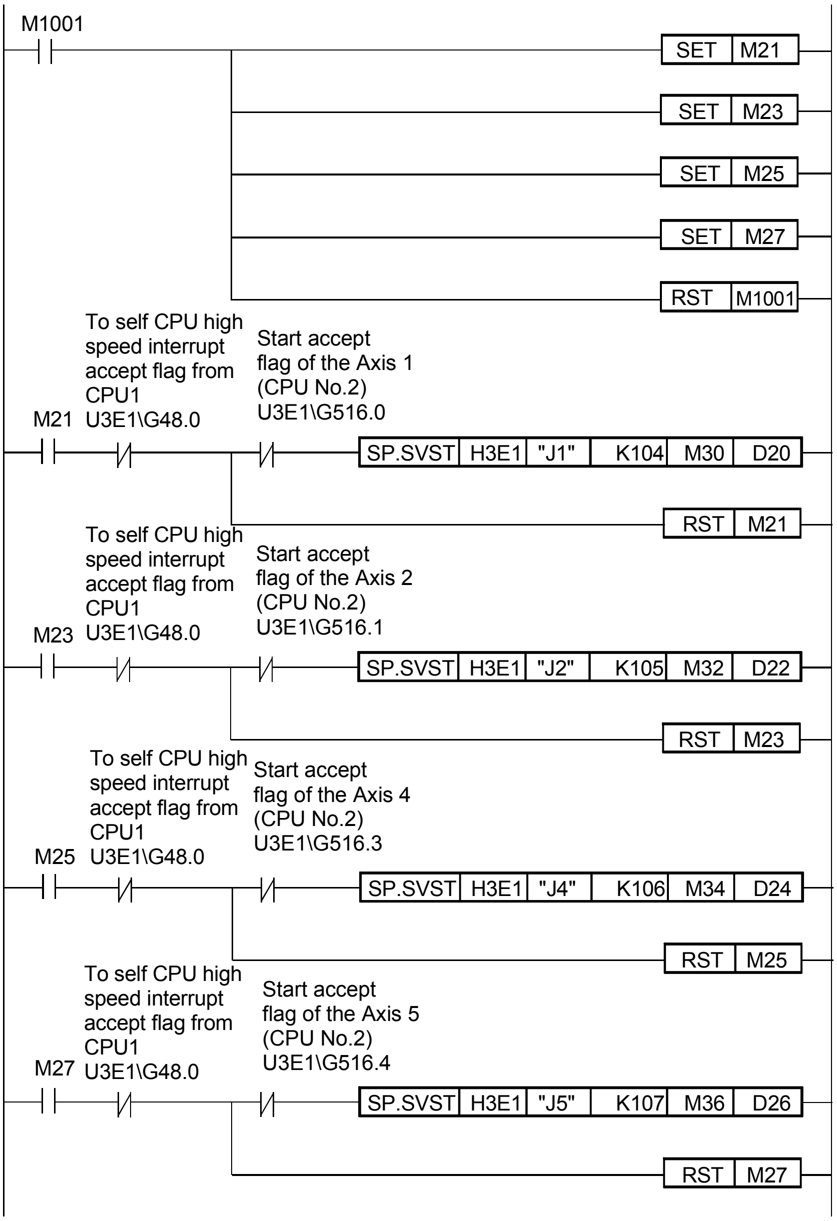
<Program example 1>

Program which executes multiple instructions to the same shaft of the Motion CPU of same CPU No..


To self CPU high speed interrupt accept flag from CPU1 U3E1\G48.0
Start accept flag of the Axis 1 (CPU No.2) U3E1\G516.0
Start accept flag of the Axis 2 (CPU No.2) U3E1\G516.1
M0
K0
RST M0
K0
SP.SVST H3E1 "J1J2" K100 M10 D0
To self CPU high speed interrupt accept flag from CPU No.1
Start accept flag of the Axis 1 (CPU No.2) U3E1\G516.0
M2 U3E1\G48.0
SP.CHGA H3E1 "J1" K0 M3 D2
To self CPU high speed interrupt accept flag from CPU No.1
RST M2
M6 U3E1\G48.0
SP.CHGT H3E1 "J2" K250 M7 D6
RST M6

<Program example 2>

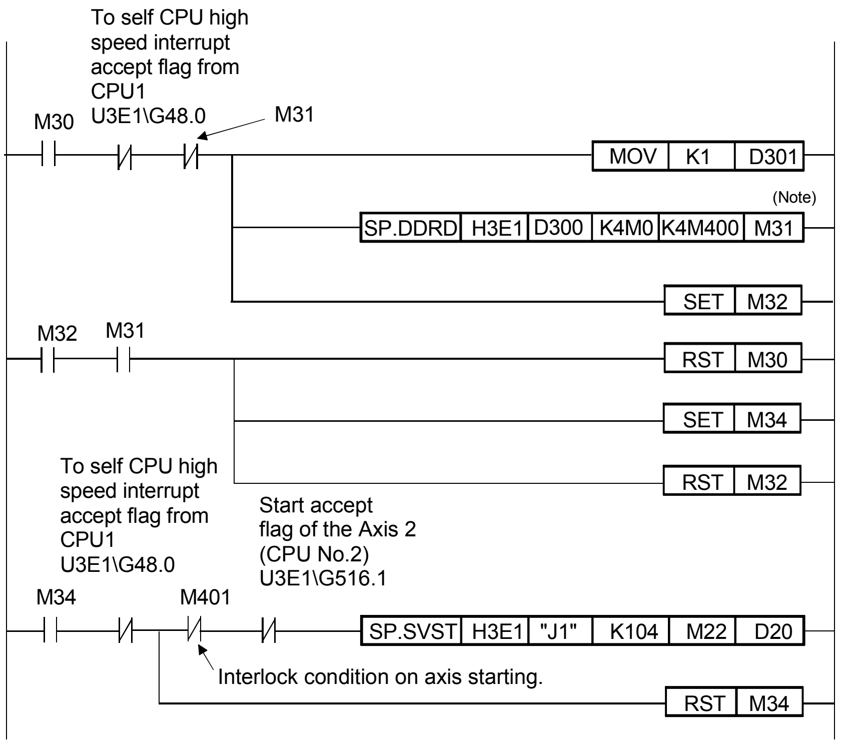
Program which executes directly multiple Motion dedicated PLC instructions because one contact-point turns on.


M1001
SET M21
SET M23
SET M25
SET M27
RST M1001
To self CPU high speed interrupt accept flag from CPU1
Start accept flag of the Axis 1 (CPU No.2)
M21 U3E1\G48.0
U3E1\G516.0
SP.SVST H3E1 "J1" K104 M30 D20
RST M21
To self CPU high speed interrupt accept flag from CPU1
Start accept flag of the Axis 2 (CPU No.2)
M23 U3E1\G48.0
U3E1\G516.1
SP.SVST H3E1 "J2" K105 M32 D22
RST M23
To self CPU high speed interrupt accept flag from CPU1
Start accept flag of the Axis 4 (CPU No.2)
M25 U3E1\G48.0
U3E1\G516.3
SP.SVST H3E1 "J4" K106 M34 D24
RST M25
To self CPU high speed interrupt accept flag from CPU1
Start accept flag of the Axis 5 (CPU No.2)
M27 U3E1\G48.0
U3E1\G516.4
SP.SVST H3E1 "J5" K107 M36 D26
RST M27

<Program example 3>

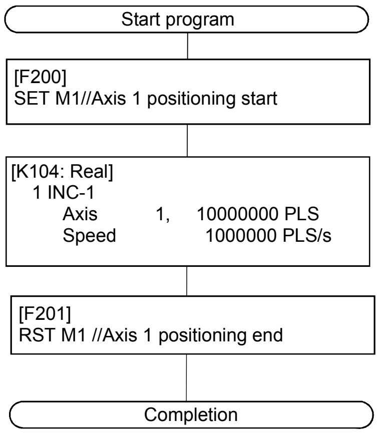
Program which executes the Motion dedicated function of the operation control step (Fn/FSn) and the motion control program (Kn).

• PLC CPU side


To self CPU high speed interrupt accept flag from CPU1
U3E1\G48.0
M30
M31
MOV K1 D301
(Note)
SP.DDRD H3E1 D300 K4M0 K4M400 M31
SET M32
M32
M31
RST M30
SET M34
RST M32
To self CPU high speed interrupt accept flag from CPU1
U3E1\G48.0
Start accept flag of the Axis 2 (CPU No.2)
U3E1\G516.1
M34
M401
SP.SVST H3E1 "J1" K104 M22 D20
Interlock condition on axis starting.
RST M34

(Note) : 4 points worth of the data from "M0" of the CPU No.2 are stored after M400 by S(P).DDRD instruction.

• Motion CPU side



POINT

Access from the PLC CPU is processed before the communication processing of the Motion CPU. Therefore, if the Motion dedicated PLC instruction is frequently performed from the PLC CPU, the scan time of the PLC CPU is not only prolonged, but delay will arise in the communication processing of the Motion CPU.

Perform execution of the Motion dedicated PLC instruction from the PLC CPU by S(P).DDWR/S(P).DDRD/S(P).CHGV instruction etc. only at the time of necessity.

(3) Complete status

The error code is stored in the complete status at abnormal completion of the Multiple CPU dedicated instruction. The error code which is stored is shown below. (The error code marked " * " is dedicated with the Motion CPU.)

Complete status (Error code)(H)	Error factor	Corrective action
0	Normal completion	Confirm a program, and correct it to a correct PLC program.
4C00 *	The specified device cannot be used in the Motion CPU. Or, it is outside the device range.	
4C01 *	The instruction for the Multiple CPU system which did not be correspond with operating system software of the Motion CPU was executed.	
4C02 *	The Motion SFC program No. to start is outside the range 0 to 255.	
4C03 *	The servo program No. to execute is outside the range 0 to 4095.	
4C04 *	Axis No. set by SVST instruction is injustice.	
4C05 *	Axis No. set by CHGA instruction is injustice.	
4C06 *	Axis No. set by CHGV instruction is injustice.	
4C07 *	Axis No. set by CHGT instruction is injustice.	
4C08 *	• When using the S(P).SFCS/S(P).SVST/S(P).CHGA instruction. There are 33 or more instruction requests to the Motion CPU from the PLC CPU in S(P).SFCS/S(P). SVST/S(P).CHGA/S(P).GINT sum table simultaneously, and the Motion CPU cannot process them. • When using the S(P).DDRD/S(P).DDWR instruction. There are 33 or more instruction requests to the Motion CPU from the PLC CPU in S(P).DDRD/S(P).DDWR sum table simultaneously, and the Motion CPU cannot process them.	
4C09 *	CPU No. of the instruction cause is injustice.	
4C0A *	Data error (The instruction which cannot be decoded in the Motion CPU was specified.)	
4C80	H/W error of the target CPU	
4C81		
4C83		
4C84		
4C90	Number over of execute instructions of the target CPU. There are 33 or more instruction requests to the Motion CPU from the PLC CPU in S(P).SFCS, S(P).SVST, S(P).CHGA, S(P).SHGV, S(P).CHGT, S(P).DDRD and S(P).DDWD sum table simultaneously, and the Motion CPU cannot process them.	

(4) Self CPU operation data area used by Motion dedicated instruction (30H to 33H)
The complete status of the to self CPU high speed interrupt accept flag from CPUn is stored in the following address.

Shared CPU memory address	Name	Description
30H(48)	To self CPU high speed interrupt accept flag from CPU1	This area is used to check whether to self CPU high speed interrupt accept flag from CPUn can be accepted or not. 0: To self CPU high speed interrupt accept flag from CPUn accept usable. 1: To self CPU high speed interrupt accept flag from CPUn accept disable.
31H(49)	To self CPU high speed interrupt accept flag from CPU2	
32H(50)	To self CPU high speed interrupt accept flag from CPU3	
33H(51)	To self CPU high speed interrupt accept flag from CPU4	

(5) System area used by Motion dedicated instruction (204H to 20DH)
The complete status of the each flag is stored in the following address.

Shared CPU memory address	Name	Description
204H(516)	Start accept flag (Axis1 to 16)	The start accept flag is stored by the 1 to 32 axis, each bit. (As for a bit's actually being set Q173CPU(N) : J1 to J32/ Q172CPU(N) : J1 to J8.) OFF : Start accept flag usable ON : Start accept flag disable b15 b1 b0 204H(516) address: J16 •••••••• J2 J1 205H(517) address: J32 •••••••• J17
205H(517)	Start accept flag (Axis17 to 32)	
206H(518)	Speed changing flag (Axis1 to 16)	The speed changing flag is stored by the 1 to 32 axis, each bit. (As for a bit's actually being set Q173CPU(N) : J1 to J32/ Q172CPU(N) : J1 to J8.) OFF : Start accept usable ON : Start accept disable b15 b1 b0 206H(518) address: J16 •••••••• J2 J1 207H(519) address: J32 •••••••• J17
207H(519)	Speed changing flag (Axis17 to 32)	
208H(520)	Synchronous encoder current value changing flag (Axis1 to 12) (Note-1)	The synchronous encoder current value change flag is stored by the 1 to 16 axis, each bit. (As for a bit's actually being set Q173CPU(N) : E1 to E12/ Q172CPU(N) : E1 to E8.) OFF : Start accept usable ON : Start accept disable b15 b1 b0 208H(520) address: E16 •••••••• E2 E1
20CH(524)	Cam axis within-one-revolution current value changing flag (Axis1 to 16) (Note-1)	The cam axis within-one-revolution current value changing flag is stored by the 1 to 32 axis, each bit. (As for a bit's actually being set Q173CPU(N) : C1 to C32/ Q172CPU(N) : C1 to C8.) OFF : Start accept usable ON : Start accept disable b15 b1 b0 20CH(524) address: C16 •••••••• C2 C1 20DH(525) address: C32 •••••••• C17
20DH(525)	Cam axis within-one-revolution current value changing flag (Axis17 to 32) (Note-1)	

(Note-1) :It can be used in SV22.

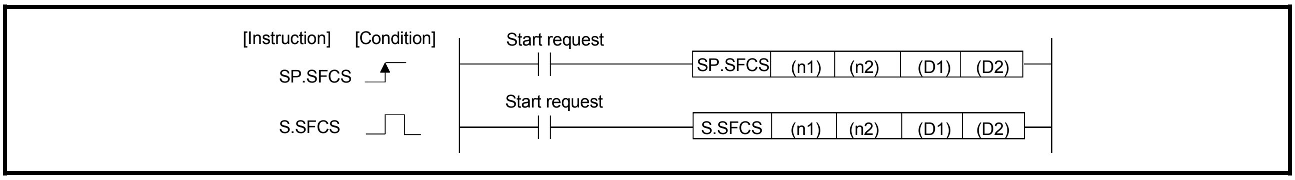
5.2 Motion SFC Start Request from The PLC CPU to The Motion CPU: S(P).SFCS (PLC instruction: S(P).SFCS)

- Motion SFC start request instruction from the PLC CPU to the Motion CPU (S(P).SFCS)

Setting data (Note)	Usable devices										
	Internal devices (System, User)		File register	Bit digit specified	Indirectly specified device	MELSECNET/10 direct J□\□		Special function module U□\G□	Index register Z□	Constant K, H	Other
	Bit	Word				Bit	Word				
(n1)		○	○	○	○					○	
(n2)		○	○	○	○					○	
(D1)	○	○	○								
(D2)		○	○		○						

○ : Usable   △ : Usable partly

(Note) : Setting data (n1) to (D2) : Index qualification possible



[Setting data]

Setting data	Description	Data type
(n1)	(First I/O No. of the target CPU)/16 Value to specify actually is the following. (Note-1) CPU No.2 : 3E1H, CPU No.3 : 3E2H, CPU No.4 : 3E3H	16-bit binary
(n2)	Motion SFC program No. to start.	16-bit binary
(D1)	Complete devices (D1+0) : Device which make turn on for one scan at start accept completion of instruction. (D1+1) : Device which make turn on for one scan at start accept abnormal completion of instruction. ("D1+0" also turns on at the abnormal completion.)	Bit
(D2)	Device to store the complete status.	16-bit binary

(Note-1) : Motion CPU cannot used CPU No.1 in the Multiple CPU configuration.

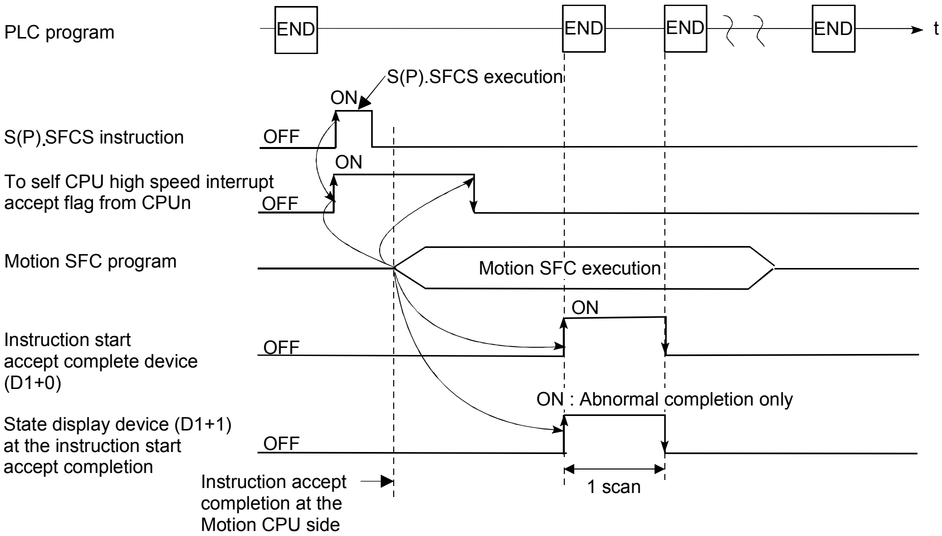
(1) This instruction is dedicated instruction toward the Motion CPU in the Multiple CPU system. Errors occurs when it was executed toward the CPU except the Motion CPU.

(2) Request to start the Motion SFC program of the program No. specified with (n2). The Motion SFC program can start any task setting of the normal task, event task and NMI task.

(3) This instruction is always effective regardless of the state of real mode/virtual mode/mode switching when the operating system software of Motion CPU is SV22.

(4) S(P).SFCS/S(P).SVST/S(P).CHGA/S(P).CHGV/S(P).CHGT/S(P).DDRD/ S(P).DDWR cannot be executed simultaneously toward the CPU executing S(P).SFCS instruction.
When the Motion dedicated PLC instruction is started continuously, it is necessary to execute the next instruction after the complete device of executing instruction turns on.

[Operation of the self CPU at execution of S(P).SFCS instruction]


PLC program
END
END
END
END
t
S(P).SFCS execution
ON
S(P).SFCS instruction
OFF
ON
To self CPU high speed interrupt accept flag from CPUn
OFF
Motion SFC program
Motion SFC execution
ON
Instruction start accept complete device (D1+0)
OFF
ON : Abnormal completion only
State display device (D1+1) at the instruction start accept completion
OFF
Instruction accept completion at the Motion CPU side
1 scan

[Errors]

The abnormal completion in the case shown below, and the error code is stored in the device specified with the complete status storing device (D2).

Complete status (Note) (Error code)(H)	Error factor	Corrective action
4C00	The specified device cannot be used in the Motion CPU. Or, it is outside the device range.	Confirm a program, and correct it to a correct PLC program.
4C01	The instruction for the Multiple CPU system which did not be correspond with operating system software of the Motion CPU was executed.	
4C02	The Motion SFC program No. to start is outside the range 0 to 255.	
4C08	There are 33 or more instruction requests to the Motion CPU from the PLC CPU in S(P).SFCS/S(P).SVST/S(P).CHGA/ S(P).GINT sum table simultaneously, and the Motion CPU cannot process them.	
4C09	CPU No. of the instruction cause is injustice.	

(Note) : 0000H (Normal)

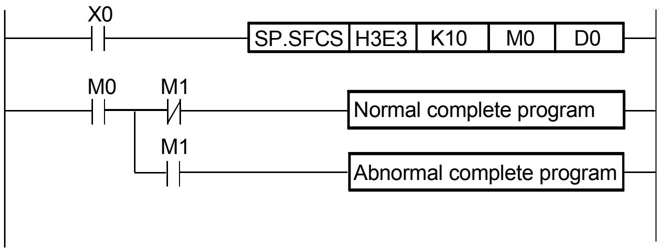
The error flag (SM0) is turned on an operation error in the case shown below, and an error code is stored in SD0.

Error code (Note)	Error factor	Corrective action
2110	The CPU No. to be set by "(First I/O No. of the target CPU)/16" is specified.	Confirm a program, and correct it to a correct PLC program.
2114	The self CPU by "(First I/O No. of the target CPU)/16" is specified.	
2117	The CPU except the Motion CPU by "(First I/O No. of the target CPU)/16" is specified.	
4002	Specified instruction is wrong.	
4004	The instruction is composed of devices except usable devices.	
4100	Since 0 to 3DFH, 3E4H is specified by "(First I/O No. of the target CPU)/16" is specified.	

(Note) : 0000H (Normal)

[Program example]

This program starts the Motion SFC program No.10 of the Motion CPU No.4.



5.3 Servo Program Start Request from The PLC CPU to The Motion CPU: S(P).SVST (PLC instruction: S(P).SVST)

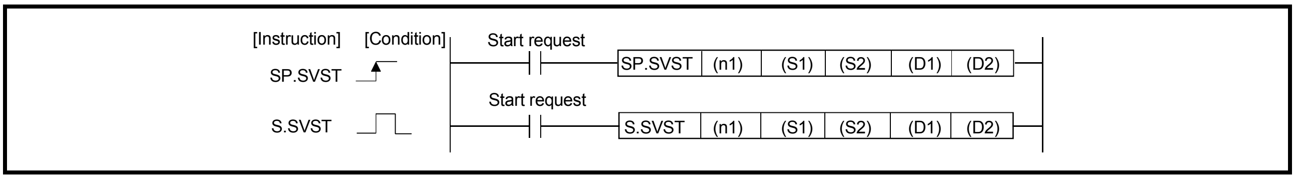
Refer to Section "1.3.4" for the applicable version of the Motion CPU and the software.

- Servo program start request instruction from the PLC CPU to the Motion CPU (S(P).SVST)

Setting data (Note)	Usable devices										
	Internal devices (System, User)		File register	Bit digit specified	Indirectly specified device	MELSECNET/10 direct J□\□		Special function module U□\G□	Index register Z□	Constant K, H	Other
	Bit	Word				Bit	Word				
(n1)		○	○	○	○					○	
(S1)		○	○		○						○
(S2)		○	○	○	○					○	
(D1)	○	○	○								
(D2)		○	○		○						

○ : Usable △ : Usable partly

(Note) : Setting data except (S1) : Index qualification possible



[Setting data]

Setting data	Description	Data type
(n1)	(First I/O No. of the target CPU)/16 Value to specify actually is the following. (Note-1) CPU No.2 : 3E1H, CPU No.3 : 3E2H, CPU No.4 : 3E3H	16-bit binary
(S1)	Axis No.("Jn") (Note-2) to start. Q173CPU(N) : J1 to J32/Q172CPU(N) : J1 to J8	Character sequence
(S2)	Servo program No. to start.	16-bit binary
(D1)	Complete devices (D1+0) : Device which make turn on for one scan at start accept completion of instruction. (D1+1) : Device which make turn on for one scan at start accept abnormal completion of instruction. ("D1+0" also turns on at the abnormal completion.)	Bit
(D2)	Device to store the complete status.	16-bit binary

(Note-1) : Motion CPU cannot used CPU No.1 in the Multiple CPU configuration.

(Note-2) : "n" shows the numerical value correspond to axis No..
Q173CPU(N) : Axis No.1 to No.32 (n=1 to 32) / Q172CPU(N) : Axis No.1 to No.8 (n=1 to 8)

[Controls]

(1) This instruction is dedicated instruction toward the Motion CPU in the Multiple CPU system. Errors occurs when it was executed toward the CPU except the Motion CPU.

(2) Request to start the servo program specified with (S2).

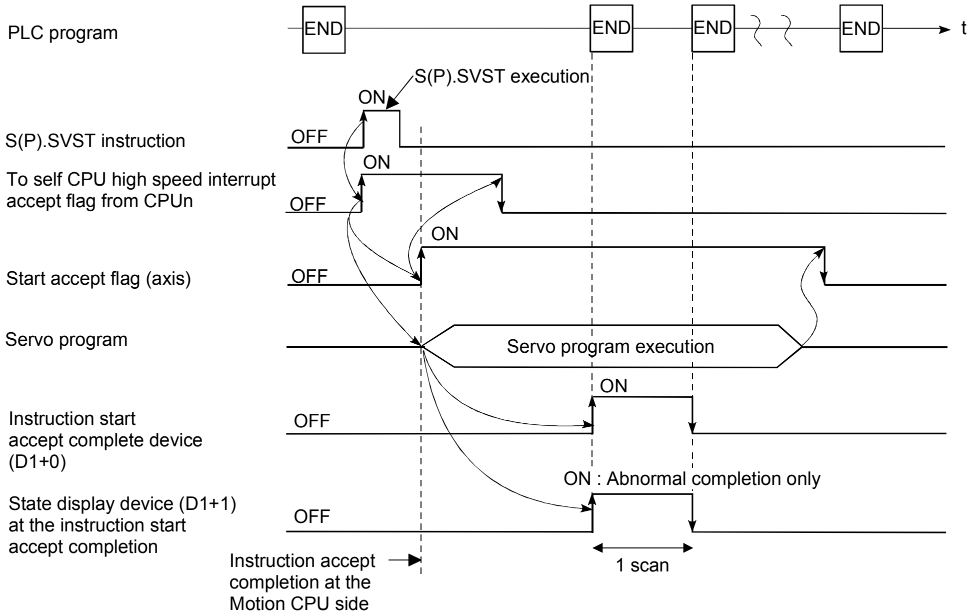
(3) This instruction is always effective regardless of the state of real mode/virtual mode/mode switching when the operating system software of Motion CPU is SV22.

(4) S(P).SFCS/S(P).SVST/S(P).CHGA/S(P).CHGV/S(P).CHGT/S(P).DDRD/ S(P).DDWR cannot be executed simultaneously toward the CPU executing S(P).SFCS instruction.
When the Motion dedicated PLC instruction is started continuously, It is necessary to take an inter-lock by the to self CPU high speed interrupt accept flag from CPUn.

(5) When the servo program is executed also at the motion control step (Kn) in the Motion CPU, it is necessary to take an inter-lock by user program, because there is no flag which can distinguish the axis starting in the PLC CPU.
Start accept flag (M2001 to M2032) of the motion devices or positioning start completion flag (M2400+20n) is used as the inter-lock condition.

(6) It is necessary to take an inter-lock by the start accept flag of the shared CPU memory so that multiple instructions may not be executed toward the same axis of the same Motion CPU No..

[Operation]


PLC program
END
END
END
END
t
S(P).SVST execution
ON
S(P).SVST instruction
OFF
ON
To self CPU high speed interrupt accept flag from CPUn
OFF
ON
Start accept flag (axis)
OFF
Servo program
Servo program execution
ON
Instruction start accept complete device (D1+0)
OFF
ON : Abnormal completion only
State display device (D1+1) at the instruction start accept completion
OFF
Instruction accept completion at the Motion CPU side
1 scan

(1) The start accept status of each axis can be confirmed with the start accept flag in the shared CPU memory of target CPU.

(2) S(P).SVST instruction accepting and normal/abnormal completion can be confirmed with the complete device (D1) or status display device (D2) at the completion.

(a) Complete device
It is turned on by the END processing of scan which the instruction completed, and turned off by the next END processing.

(b) Status display device at the completion
It is turned on/off according to the status of the instruction completion.

- Normal completion : OFF
- Abnormal completion : It is turned on by the END processing of scan which the instruction completed, and turned off by the next END processing.

[Setting range]

(1) Setting of the starting axis
The starting axis set as (S1) sets J + Axis No. in a character sequence " ".

	(S1) usable range
Q173CPU(N)	1 to 32
Q172CPU(N)	1 to 8

Up to 8 axes can be set. If multiple axes are set, it sets without dividing in a space etc,.
The axis No. set in the system setting (Refer to Section 1.5) is used as the axis No. to start.
And, the axis No. to start does not need to be a order.

Example) When multiple axes (Axis1, Axis2, Axis10, Axis11) are set.
"J1J2J10J11"

(2) Setting of the servo program No.

(S2) usable range
0 to 4095

[Start accept flag (System area)]

The complete status of the start accept flag is stored in the address of the start accept flag in the shared CPU memory.

Shared CPU memory address ( ) is decimal address	Description

204H(516)
205H(517)
	The start accept flag is stored by the 1 to 32 axis, each bit.
	(As for a bit's actually being set Q173CPU(N) : J1 to J32/ Q172CPU(N) : J1 to J8.)
	OFF : Start accept flag usable
	ON : Start accept flag disable
	b15 b1 b0
	204H(516) address: J16 • • • • • • • • • J2 J1
	205H(517) address: J32 • • • • • • • • • J17

[Errors]

The abnormal completion in the case shown below, and the error code is stored in the device specified with the complete status storing device (D2).

Complete status (Note) (Error code)(H)	Error factor	Corrective action
4C00	The specified device cannot be used in the Motion CPU. Or, it is outside the device range.	Confirm a program, and correct it to a correct PLC program.
4C01	The instruction for the Multiple CPU system which did not be correspond with operating system software of the Motion CPU was executed.	
4C03	The servo program No. to execute is outside the range 0 to 4095.	
4C04	Axis No. set by SVST instruction is injustice.	
4C08	There are 33 or more instruction requests to the Motion CPU from the PLC CPU in S(P).SFCS/ S(P).SVST/S(P).CHGA/S(P).GINT sum table simultaneously, and the Motion CPU cannot process them.	
4C09	CPU No. of the instruction cause is injustice.	

(Note) : 0000H (Normal)

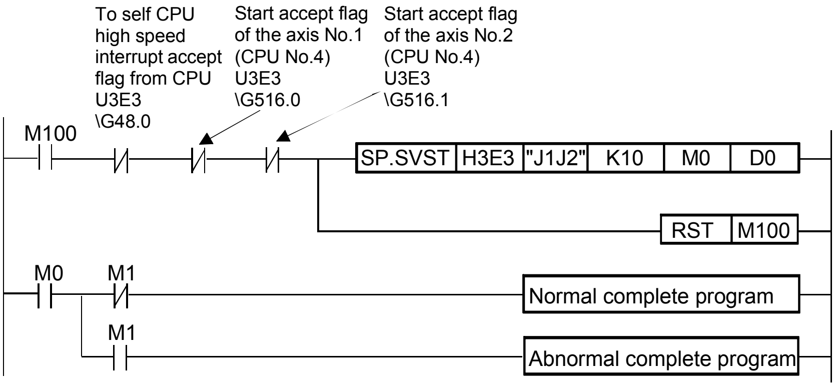
The error flag (SM0) is turned on an operation error in the case shown below, and an error code is stored in SD0.

Error code (Note)	Error factor	Corrective action
2110	The CPU No. to be set by "(First I/O No. of the target CPU)/16" is specified.	Confirm a program, and correct it to a correct PLC program.
2114	The self CPU is by "(First I/O No. of the target CPU)/16" is specified.	
2117	The CPU except the Motion CPU by "(First I/O No. of the target CPU)/16" is specified.	
4004	The instruction be composed of devices except usable devices.	
4100	Since 0 to 3DFH, 3E4H is specified by "(First I/O No. of the target CPU)/16" is specified.	

(Note) : 0000H (Normal)

[Program example]

Program which requests to start the servo program No.10 toward axis No.1 and No.2 of the Motion CPU No.4. from the PLC CPU No.1.


To self CPU high speed interrupt accept flag from CPU U3E3 \G48.0
Start accept flag of the axis No.1 (CPU No.4) U3E3 \G516.0
Start accept flag of the axis No.2 (CPU No.4) U3E3 \G516.1
M100
SP.SVST
H3E3
"J1J2"
K10
M0
D0
RST
M100
M0
M1
Normal complete program
M1
Abnormal complete program

5.4 Current Value Change Instruction from The PLC CPU to The Motion CPU: S(P).CHGA (PLC instruction: S(P).CHGA)

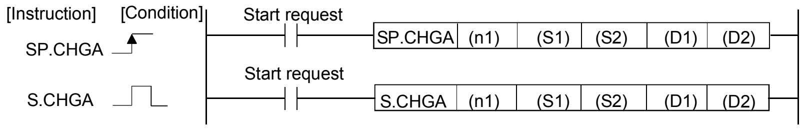
Refer to Section "1.3.4" for the applicable version of the Motion CPU and the software.

- Current value change instruction from the PLC CPU to the Motion CPU (S(P).CHGA)

Setting data (Note)	Usable devices										
	Internal devices (System, User)		File register	Bit digit specified	Indirectly specified device	MELSECNET/10 direct J□\□		Special function module U□\G□	Index register Z□	Constant K, H	Other
	Bit	Word				Bit	Word				
(n1)		○	○	○	○					○	
(S1)		○	○		○						○
(S2)		○	○	○	○					○	
(D1)	○	○	○								
(D2)		○	○		○						

○ : Usable △ : Usable partly

(Note) : Setting data except (S1) : Index qualification possible



[Setting data]

Setting data	Description	Data type
(n1)	(First I/O No. of the target CPU)/16 Value to specify actually is the following. (Note-1) CPU No.2 : 3E1H, CPU No.3 : 3E2H, CPU No.4 : 3E3H	16-bit binary
(S1)	Axis No. ("Jn") (Note-2) to execute the current value change. Q173CPU(N) : J1 to J32/Q172CPU(N) : J1 to J8	Character sequence
	Synchronous encoder axis No. ("En") to execute the current value change. Q173CPU(N) : E1 to E12/Q172CPU(N) : E1 to E8	
	Cam axis No. ("Cn") to execute the within-one-revolution current value change. Q173CPU(N) : C1 to C32/Q172CPU(N) : C1 to C8	
(S2)	Setting of the current value to change.	32-bit binary
(D1)	Complete devices (D1+0) : Device which make turn on for one scan at start accept completion of instruction. (D1+1) : Device which make turn on for one scan at start accept abnormal completion of instruction. ("D1+0" also turns on at the abnormal completion.)	Bit
(D2)	Device to store the complete status.	16-bit binary

(Note-1) : Motion CPU cannot used CPU No.1 in the Multiple CPU configuration.

(Note-2) : "n" shows the numerical value which correspond to axis No..
Q173CPU(N) : Axis No.1 to No.32 (n=1 to 32) / Q172CPU(N) : Axis No.1 to No.8 (n=1 to 8)

● When an axis No."Jn" was specified with (S1)

[Controls]

(1) This instruction is dedicated instruction toward the Motion CPU in the Multiple CPU system. Errors occurs when it was executed toward the CPU except the Motion CPU.

(2) The current value change of axis (stopped axis) No. specified with (S1) is changed into the current value specified (S2).

(3) This instruction is always effective regardless of the state of real mode/virtual mode/mode switching when the operating system software of Motion CPU is SV22.

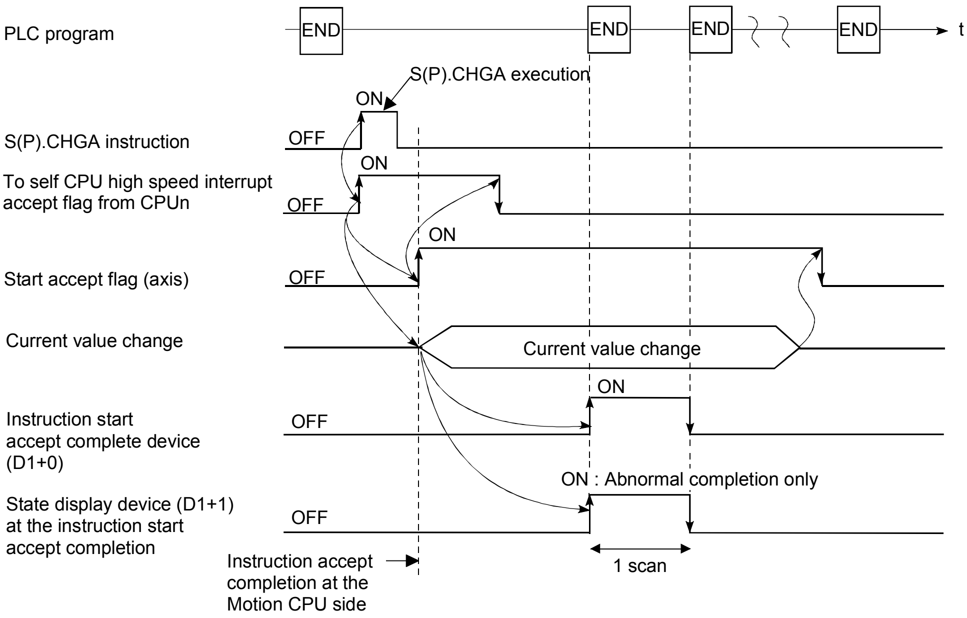
(4) S(P).SFCS/S(P).SVST/S(P).CHGA/S(P).CHGV/S(P).CHGT/S(P).DDRD/ S(P).DDWR cannot be executed simultaneously toward the CPU executing S(P).CHGA instruction.
When the Motion dedicated PLC instruction is started continuously, It is necessary to take an inter-lock by the to self CPU high speed interrupt accept flag from CPUn.

(5) When the servo program is executed also at the motion control step (Kn) in the Motion CPU, it is necessary to take an inter-lock by user program, because there is no flag which can distinguish the axis starting in the PLC CPU.
Start accept flag (M2001 to M2032) of the motion devices is used as the inter-lock condition in the Motion CPU.

(6) It is necessary to take an inter-lock by the start accept flag of the shared CPU memory so that multiple instructions may not be executed toward the same axis of the same Motion CPU No..

(7) The current change value is also possible when the servo program which execute the CHGA instruction toward an axis is executed in the S(P).SVST instruction.

[Operation]


PLC program
END
END
END
END
t
S(P).CHGA execution
ON
S(P).CHGA instruction
OFF
ON
To self CPU high speed interrupt accept flag from CPUn
OFF
ON
Start accept flag (axis)
OFF
Current value change
Current value change
ON
Instruction start accept complete device (D1+0)
OFF
ON : Abnormal completion only
State display device (D1+1) at the instruction start accept completion
OFF
Instruction accept completion at the Motion CPU side
1 scan

(1) The start accept status of each axis can be confirmed with the start accept flag in the shared CPU memory of target CPU.

(2) S(P).CHGA instruction accepting and normal/abnormal completion can be confirmed with the complete device (D1) or status display device (D2) at the completion.

(a) Complete device
It is turned on by the END processing of scan which the instruction completed, and turned off by the next END processing.

(b) Status display device at the completion
It is turned on/off according to the status of the instruction completion.
- ● Normal completion : OFF
- ● Abnormal completion : It is turned on by the END processing of scan which the instruction completed, and turned off by the next END processing.

[Setting range]

(1) Setting of axis to execute the current value change.
The starting axis set as (S1) sets J + Axis No. in a character sequence " ".

	(S1) usable range
Q173CPU(N)	1 to 32
Q172CPU(N)	1 to 8

The number of axes which can set are only 1 axis.
The axis No. set in the system setting (Refer to Section 1.5) is used as the axis No. to start.

(2) Setting of the current value to change.

(S2) usable range
-2147483648 to 2147483647

[Start accept flag (System area)]

The complete status of the start accept flag is stored in the address of the start accept flag in the shared CPU memory.

Shared CPU memory address ( ) is decimal address	Description

204H(516)
205H(517)
	The start accept flag is stored by the 1 to 32 axis, each bit.
	(As for a bit's actually being set Q173CPU(N) : J1 to J32/ Q172CPU(N) : J1 to J8.)
	OFF : Start accept flag usable
	ON : Start accept flag disable
	b15 ... b1 b0
	204H(516) address: J16 ••••••••• J2 J1
	205H(517) address: J32 ••••••••• J17

[Errors]

The abnormal completion in the case shown below, and the error code is stored in the device specified with the complete status storing device (D2).

Complete status (Note) (Error code)(H)	Error factor	Corrective action
4C00	The specified device cannot be used in the Motion CPU. Or, it is outside the device range.	Confirm a program, and correct it to a correct PLC program.
4C01	The instruction for the Multiple CPU system which did not be correspond with operating system software of the Motion CPU was executed.	
4C05	Axis No. set by CHGA instruction is injustice.	
4C08	There are 33 or more instruction requests to the Motion CPU from the PLC CPU in S(P).SFCS/ S(P).SVST/S(P).CHGA/S(P).GINT sum table simultaneously, and the Motion CPU cannot process them.	
4C09	CPU No. of the instruction cause is injustice.	

(Note) : 0000H (Normal)

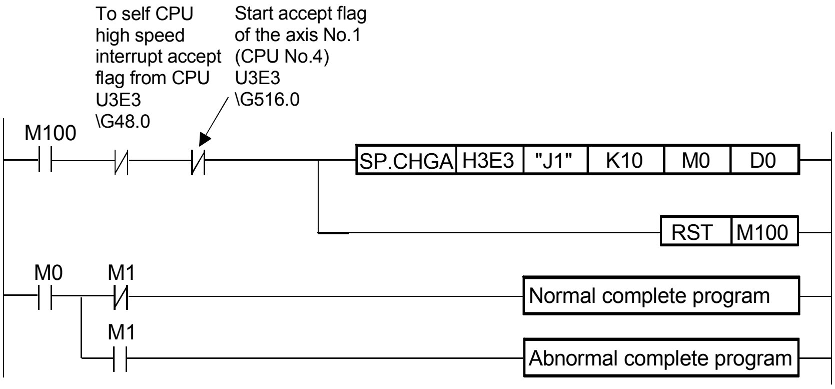
The error flag (SM0) is turned on an operation error in the case shown below, and an error code is stored in SD0.

Error code (Note)	Error factor	Corrective action
2110	The CPU No. to be set by "(First I/O No. of the target CPU)/16" is specified.	Confirm a program, and correct it to a correct PLC program.
2114	The self CPU by "(First I/O No. of the target CPU)/16" is specified.	
2117	The CPU except the Motion CPU by "(First I/O No. of the target CPU)/16" is specified.	
4004	The instruction is composed of devices except usable devices.	
4100	Since 0 to 3DFH, 3E4H by "(First I/O No. of the target CPU)/16" is specified.	

(Note) : 0000H (Normal)

[Program example]

Program which changes the current value of the axis No.1 of the Motion CPU (CPU No.4) from PLC CPU (CPU No.1) to 10.


To self CPU high speed interrupt accept flag from CPU U3E3 \G48.0
Start accept flag of the axis No.1 (CPU No.4) U3E3 \G516.0
M100
SP.CHGA
H3E3
"J1"
K10
M0
D0
RST
M100
M0
M1
Normal complete program
M1
Abnormal complete program

● When an axis No."En" was specified with (S1)

[Controls]

(1) This instruction is dedicated instruction toward the Motion CPU at the Multiple CPU system. Errors occurs when it was executed toward the CPU except the Motion CPU.

(2) The synchronous encoder axis current value specified with (S1) is changed into the current value specified (S2) at the virtual mode.

(3) This instruction is always effective regardless of the state of real mode/virtual mode/mode switching when the operating system software of Motion CPU is SV22.

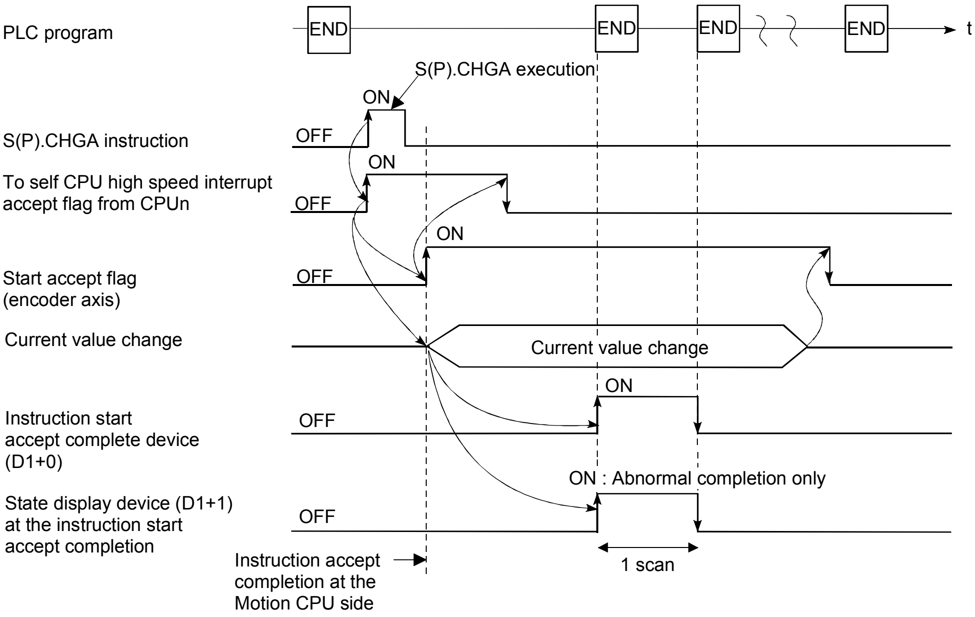
(4) S(P).SFCS/S(P).SVST/S(P).CHGA/S(P).CHGV/S(P).CHGT/S(P).DDRD/ S(P).DDWR cannot be executed simultaneously toward the CPU executing S(P).CHGA instruction.
When the Motion dedicated PLC instruction is started continuously, It is necessary to take an inter-lock by the to self CPU high speed interrupt accept flag from CPUn.

(5) When the servo program is executed also at the motion control step (Kn) in the Motion CPU, it is necessary to take an inter-lock by user program, because there is no flag which can distinguish the axis starting in the PLC CPU.
Synchronous encoder current value changing flag (M2101 to M2112) of the motion devices is used as the inter-lock condition in the Motion CPU.

(6) It is necessary to take an inter-lock by the current value changing flag of the shared CPU memory so that multiple instructions may not be executed toward the same synchronous encoder axis of the same Motion CPU No..

(7) The current change value is also possible when the servo program which execute the CHGA instruction toward the synchronous encoder axis is executed in the S(P).SVST instruction.

[Operation]


PLC program
END
END
END
END
t
S(P).CHGA execution
S(P).CHGA instruction
ON
OFF
To self CPU high speed interrupt accept flag from CPUn
ON
OFF
Start accept flag (encoder axis)
ON
OFF
Current value change
Current value change
Instruction start accept complete device (D1+0)
ON
OFF
ON : Abnormal completion only
State display device (D1+1) at the instruction start accept completion
OFF
Instruction accept completion at the Motion CPU side
1 scan

(1) The current value status of the synchronous encoder axis can be confirmed with the current value changing in the shared CPU memory of target CPU.

(2) S(P).CHGA instruction accepting and normal/abnormal completion can be confirmed with the complete device (D1) or status display device (D2) at the completion.

(a) Complete device

It is turned on by the END processing of scan which the instruction completed, and turned off by the next END processing.

(b) Status display device at the completion

It is turned on/off according to the status of the instruction completion.

- Normal completion : OFF
- Abnormal completion : It is turned on by the END processing of scan which the instruction completed, and turned off by the next END processing.

[Setting range]

(1) Setting of the synchronous encoder axis to execute the current value change. The synchronous encoder axis to execute the current value change set as (S1) sets E + synchronous encoder axis No. in a character sequence " ".

	(S1) usable range
Q173CPU(N)	1 to 12
Q172CPU(N)	1 to 8

The number of axes which can set are only 1 axis.
The axis No. set in the system setting (Refer to Section 1.5) is used as the axis No. to start.

(2) Setting of the current value to change.

(S2) usable range
-2147483648 to 2147483647

[Synchronous encoder current value changing flag (System area)]

The complete status of the synchronous encoder current value changing flag is stored in the address of the synchronous encoder current value changing flag in the shared CPU memory.

Shared CPU memory address ( ) is decimal address	Description
208H(520)	The synchronous encoder current value changing flag is stored by the 1 to 16 axis, each bit. (As for a bit's actually being set Q173CPU(N) : E1 to E12/ Q172CPU(N) : E1 to E8.) OFF : Start accept usable ON : Start accept disable b15 b1 b0 208H(520) address E16 • • • • • • • • • E2 E1

[Errors]

The abnormal completion in the case shown below, and the error code is stored in the device specified with the complete status storing device (D2).

Complete status (Note) (Error code)(H)	Error factor	Corrective action
4C00	The specified device cannot be used in the Motion CPU. Or, it is outside the device range.	Confirm a program, and correct it to a correct PLC program.
4C01	The instruction for the Multiple CPU system which did not be correspond with operating system software of the Motion CPU was executed.	
4C05	Axis No. set by CHGA instruction is injustice.	
4C08	There are 33 or more instruction requests to the Motion CPU from the PLC CPU in S(P).SFCS/ S(P).SVST/S(P).CHGA/S(P).GINT sum table simultaneously, and the Motion CPU cannot process them.	
4C09	CPU No. of the instruction cause is injustice.	

(Note) : 0000H (Normal)

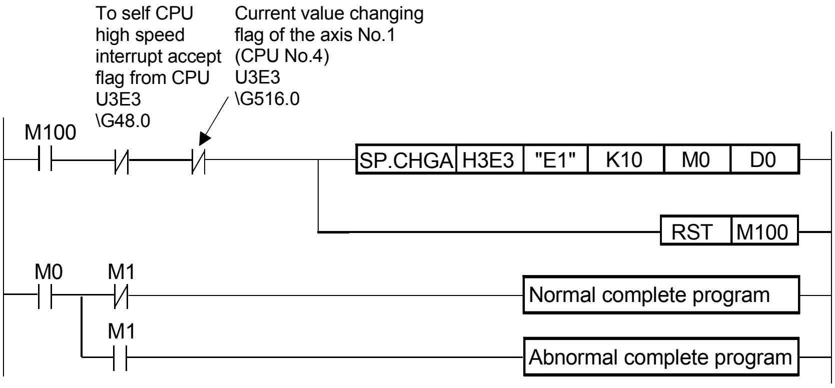
The error flag (SM0) is turned on an operation error in the case shown below, and an error code is stored in SD0.

Error code (Note)	Error factor	Corrective action
2110	The CPU No. to be set by "(First I/O No. of the target CPU)/16" is specified.	Confirm a program, and correct it to a correct PLC program.
2114	The self CPU by "(First I/O No. of the target CPU)/16" is specified.	
2117	The CPU except the Motion CPU by "(First I/O No. of the target CPU)/16" is specified.	
4004	The instruction is composed of devices except usable devices.	
4100	Since 0 to 3DFH, 3E4H by "(First I/O No. of the target CPU)/16" is specified.	

(Note) : 0000H (Normal)

[Program example]

Program which changes the current value of the axis No.1 of the Motion CPU (CPU No.4) from PLC CPU (CPU No.1) to 10.


To self CPU high speed interrupt accept flag from CPU U3E3 \G48.0
Current value changing flag of the axis No.1 (CPU No.4) U3E3 \G516.0
M100
SP.CHGA
H3E3
"E1"
K10
M0
D0
RST
M100
M0
M1
Normal complete program
M1
Abnormal complete program

● When an axis No."Cn" was specified with (S1)

[Controls]

(1) This instruction is dedicated instruction toward the Motion CPU in the Multiple CPU system. Errors occurs when it was executed toward the CPU except the Motion CPU.

(2) The cam axis within-one-revolution current value specified with (S1) is changed into the current value specified (S2) at the virtual mode.

(3) This instruction is always effective regardless of the state of real mode/virtual mode/mode switching when the operating system software of Motion CPU is SV22.

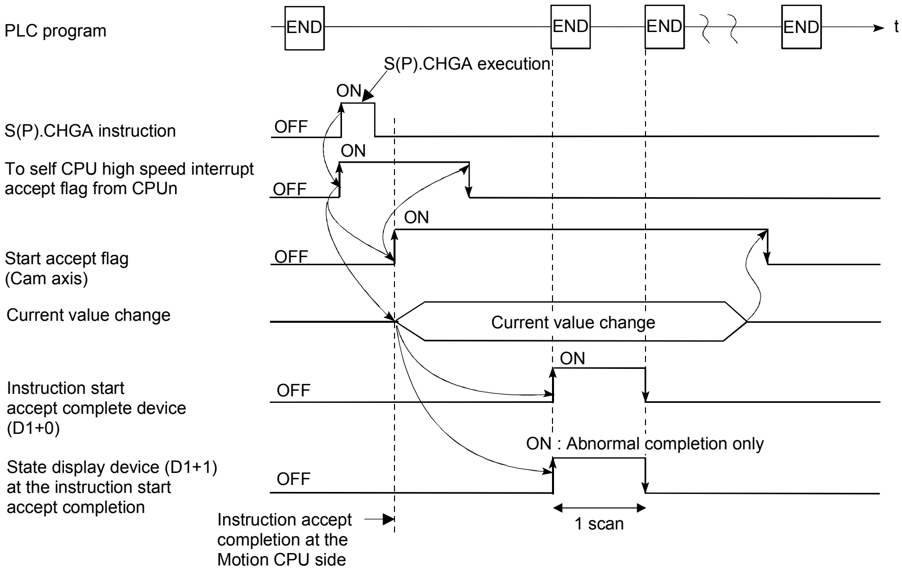
(4) S(P).SFCS/S(P).SVST/S(P).CHGA/S(P).CHGV/S(P).CHGT/S(P).DDRD/ S(P).DDWR cannot be executed simultaneously toward the CPU executing S(P).CHGA instruction.
When the Motion dedicated PLC instruction is started continuously, It is necessary to take an inter-lock by the to self CPU high speed interrupt accept flag from CPUn.

(5) When the servo program is executed also at the motion control step (Kn) in the Motion CPU, it is necessary to take an inter-lock by user program, because there is no flag which can distinguish the axis starting in the PLC CPU.

(6) It is necessary to take an inter-lock by the cam axis within-one-revolution current value changing flag of the shared CPU memory so that multiple instructions may not be executed toward the same cam axis of the same Motion CPU No..

(7) The current change value is also possible when the servo program which execute the CHGA instruction toward the cam axis is executed in the S(P).SVST instruction.

[Operation]


PLC program
END
END
END
END
t
S(P).CHGA execution
ON
S(P).CHGA instruction
OFF
ON
To self CPU high speed interrupt accept flag from CPUn
OFF
ON
Start accept flag (Cam axis)
OFF
Current value change
Current value change
ON
Instruction start accept complete device (D1+0)
OFF
ON : Abnormal completion only
State display device (D1+1) at the instruction start accept completion
OFF
Instruction accept completion at the Motion CPU side
1 scan

(1) The current value status of the cam axis within-one-revolution current value change can be confirmed with the cam axis within-one-revolution current value changing flag in the shared CPU memory of target CPU.

(2) S(P).CHGA instruction accepting and normal/abnormal completion can be confirmed with the complete device (D1) or status display device (D2) at the completion.

(a) Complete device
It is turned on by the END processing of scan which the instruction completed, and turned off by the next END processing.

(b) Status display device at the completion
It is turned on/off according to the status of the instruction completion.

- Normal completion : OFF
- Abnormal completion : It is turned on by the END processing of scan which the instruction completed, and turned off by the next END processing.

[Setting range]

(1) Setting the cam axis which execute the within-one-revolution current value change.
The cam axis to execute the within-one-revolution current value change set as (S1) sets C + cam axis No. in a character sequence " ".

	(S1) usable range
Q173CPU(N)	1 to 32
Q172CPU(N)	1 to 8

The number of axes which can set are only 1 axis.
The axis No. set in the system setting (Refer to Section 1.5) is used as the axis No. to start.

(2) Setting of the current value to change.

(S2) usable range
-2147483648 to 2147483647

[Cam axis within-one-revolution current value changing flag (System area)]

The complete status of the cam axis within-one-revolution current value changing flag is stored in the address of the cam axis within-one-revolution current value changing flag in the shared CPU memory.

Shared CPU memory address ( ) is decimal address	Description

20CH(524)
20DH(525)
	The cam axis within-one-revolution current value changing flag is stored by the 1 to 32 axis, each bit.
	(As for a bit's actually being set Q173CPU(N) : C1 to C32/ Q172CPU(N) : C1 to C8.)
	OFF : Start accept usable
	ON : Start accept disable
	b15 •••••••• b1 b0
	20CH(524) address: C16 •••••••• C2 C1
	20DH(525) address: C32 •••••••• C17

[Errors]

The abnormal completion in the case shown below, and the error code is stored in the device specified with the complete status storing device (D2).

Complete status (Note) (Error code)(H)	Error factor	Corrective action
4C00	The specified device cannot be used in the Motion CPU. Or, it is outside the device range.	Confirm a program, and correct it to a correct PLC program.
4C01	The instruction for the Multiple CPU system which did not be correspond with operating system software of the Motion CPU was executed.	
4C05	Axis No. set by CHGA instruction is injustice.	
4C08	There are 33 or more instruction requests to the Motion CPU from the PLC CPU in S(P).SFCS/ S(P).SVST/S(P).CHGA/S(P).GINT sum table simultaneously, and the Motion CPU cannot process them.	
4C09	CPU No. of the instruction cause is injustice.	

(Note) : 0000H (Normal)

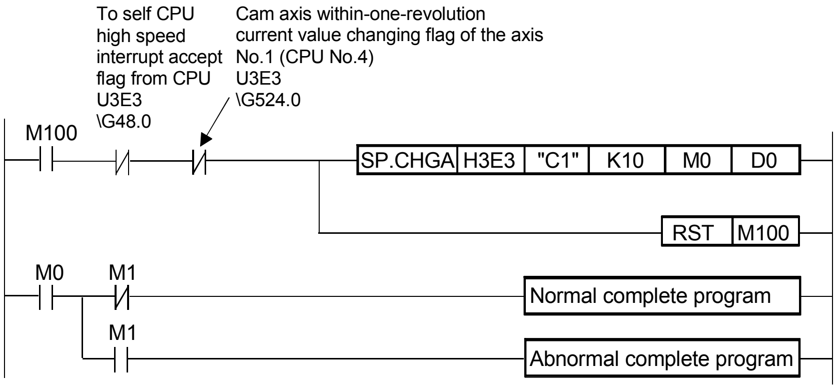
The error flag (SM0) is turned on an operation error in the case shown below, and an error code is stored in SD0.

Error code (Note)	Error factor	Corrective action
2110	The CPU No. to be set by "(First I/O No. of the target CPU)/16" is specified.	Confirm a program, and correct it to a correct PLC program.
2114	The self CPU by "(First I/O No. of the target CPU)/16" is specified.	
2117	The CPU except the Motion CPU by "(First I/O No. of the target CPU)/16" is specified.	
4004	The instruction is composed of devices except usable devices.	
4100	Since 0 to 3DFH, 3E4H by "(First I/O No. of the target CPU)/16" is specified.	

(Note) : 0000H (Normal)

[Program example]

Program which changes the current value of the axis No.1 of the Motion CPU (CPU No.4) from PLC CPU (CPU No.1) to 10.


To self CPU high speed interrupt accept flag from CPU U3E3 \G48.0
Cam axis within-one-revolution current value changing flag of the axis No.1 (CPU No.4) U3E3 \G524.0
M100
SP.CHGA
H3E3
"C1"
K10
M0
D0
RST
M100
M0
M1
M1
Normal complete program
Abnormal complete program

5.5 Speed Change Instruction from The PLC CPU to The Motion CPU: S(P).CHGV (PLC instruction: S(P).CHGV)

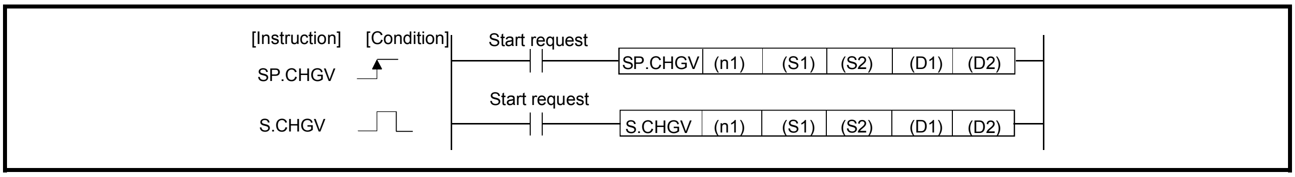
Refer to Section "1.3.4" for the applicable version of the Motion CPU and the software.

- Speed change instruction (S(P).CHGV)

Setting data (Note)	Usable devices										
	Internal devices (System, User)		File register	Bit digit specified	Indirectly specified device	MELSECNET/10 direct J□\□		Special function module U□\G□	Index register Z□	Constant K, H	Other
	Bit	Word				Bit	Word				
(n1)		○	○	○	○					○	
(S1)		○	○		○						○
(S2)		○	○	○	○					○	
(D1)	○	○	○								
(D2)		○	○		○						

○ : Usable △ : Usable partly

(Note) :Setting data except (S1) : Index qualification possible



[Setting data]

Setting data	Description	Data type
(n1)	(First I/O No. of the target CPU)/16 Value to specify actually is the following. (Note-1) CPU No.2 : 3E1H, CPU No.3 : 3E2H, CPU No.4 : 3E3H	16-bit binary
(S1)	Axis No. ("Jn") (Note-2) to execute the speed change. Q173CPU(N) : J1 to J32/Q172CPU(N) : J1 to J8	Character sequence
(S2)	Setting of the current value to change.	16-bit binary
(D1)	Complete devices (D1+0) : Device which make turn on for one scan at start accept completion of instruction. (D1+1) : Device which make turn on for one scan at start accept abnormal completion of instruction. ("D1+0" also turns on at the abnormal completion.)	Bit
(D2)	Device to store the complete status.	16-bit binary

(Note-1) : Motion CPU cannot used CPU No.1 in the Multiple CPU configuration.

(Note-2) : "n" shows the numerical value which correspond to axis No..
Q173CPU(N) : Axis No.1 to No.32 (n=1 to 32) / Q172CPU(N) : Axis No.1 to No.8 (n=1 to 8)

[Controls]

(1) This instruction is dedicated instruction toward the Motion CPU in the Multiple CPU system. Errors occurs when it was executed toward the CPU except the Motion CPU.

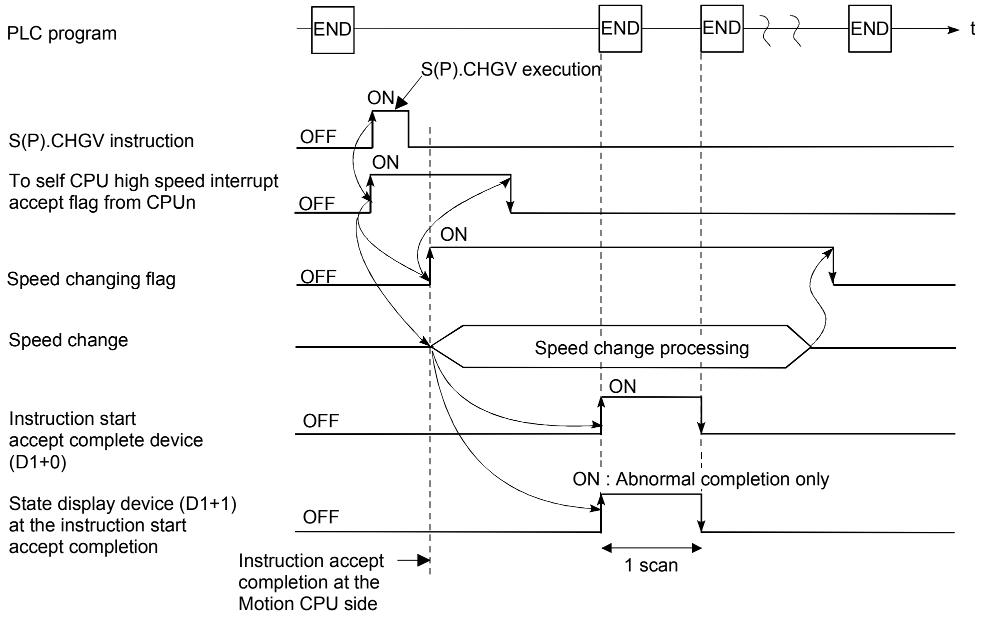
(2) The speed change is executed of the axis specified with (S1) during positioning or JOG operating.

(3) S(P).SFCS/S(P).SVST/S(P).CHGA/S(P).CHGV/S(P).CHGT/S(P).DDRD/ S(P).DDWR cannot be executed simultaneously toward the CPU executing S(P).CHGV instruction.
When the Motion dedicated PLC instruction is started continuously, It is necessary to take an inter-lock by the to self CPU high speed interrupt accept flag from CPUn.

(4) When the speed change is executed also at the operation control step (Fn/FSn) in the Motion CPU, it is necessary to take an inter-lock by user program, because there is no flag which can distinguish the speed changing in the PLC CPU.
Speed changing flag (M2061 to M2092) of the motion devices is used as the inter-lock condition in the Motion CPU.

(5) It is necessary to take an inter-lock by the speed changing flag of the shared CPU memory so that multiple instructions may not be executed toward the same axis of the same Motion CPU No..

[Operation]


PLC program
END
END
END
END
t
S(P).CHGV execution
ON
S(P).CHGV instruction
OFF
ON
To self CPU high speed interrupt accept flag from CPUn
OFF
ON
Speed changing flag
OFF
Speed change
Speed change processing
ON
Instruction start accept complete device (D1+0)
OFF
ON : Abnormal completion only
State display device (D1+1) at the instruction start accept completion
OFF
Instruction accept completion at the Motion CPU side
1 scan

[Setting range]

(1) Setting of axis to execute the speed change.

The axis to execute the speed change set as (S1) sets J + axis No. in a character sequence " ".

	(S1) usable range
Q173CPU(N)	1 to 32
Q172CPU(N)	1 to 8

The number of axes which can set are only 1 axis.
The axis No. set in the system setting (Refer to Section 1.5) is used as the axis No. to start.

(2) Setting of the speed to change.

(S2) usable range
-2147483648 to 2147483647

[Speed changing flag (System area)]

The complete status of the start accept flag is stored in the address of the start accept flag in the shared CPU memory.

<table>
<tr><th>Shared CPU memory address
( ) is decimal address</th><th>Description</th></tr>
<tr><td>206H(518)
207H(519)</td><td>The start accept flag is stored by the 1 to 32 axis, each bit.
(As for a bit's actually being set Q173CPU(N) : J1 to J32/ Q172CPU(N) : J1 to J8.)
OFF : Start accept usable
ON : Start accept disable
<table>
<tr><th></th><th>b15</th><th></th><th>b1</th><th>b0</th></tr>
<tr><td>206H(518) address</td><td>J16</td><td>・・・・・・・・・</td><td>J2</td><td>J1</td></tr>
<tr><td>207H(519) address</td><td>J32</td><td>・・・・・・・・・</td><td></td><td>J17</td></tr>
</table></td></tr>
</table>

[Errors]

The abnormal completion in the case shown below, and the error code is stored in the device specified with the complete status storing device (D2).

Complete status (Note) (Error code)(H)	Error factor	Corrective action
4C00	The specified device cannot be used in the Motion CPU. Or, it is outside the device range.	Confirm a program, and correct it to a correct PLC program.
4C01	The instruction for the Multiple CPU system which did not be correspond with operating system software of the Motion CPU was executed.	
4C06	Axis No. set by CHGV instruction is injustice.	
4C09	CPU No. of the instruction cause is injustice.	

(Note) : 0000H (Normal)

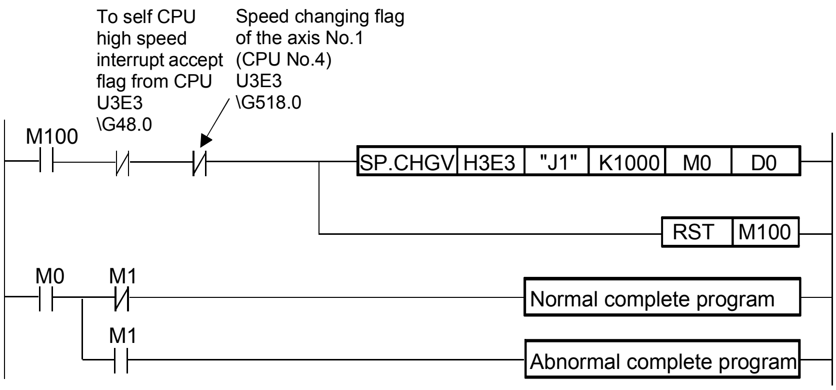
The error flag (SM0) is turned on an operation error in the case shown below, and an error code is stored in SD0.

Error code (Note)	Error factor	Corrective action
2110	The CPU No. to be set by "(First I/O No. of the target CPU)/16" is specified.	Confirm a program, and correct it to a correct PLC program.
2114	The self CPU by "(First I/O No. of the target CPU)/16" is specified.	
2117	The CPU except the Motion CPU by "(First I/O No. of the target CPU)/16" is specified.	
4004	The instruction is composed of devices except usable devices.	
4100	Since 0 to 3DFH, 3E4H by "(First I/O No. of the target CPU)/16" is specified.	

(Note) : 0000H (Normal)

[Program example]

Program which changes the positioning speed of the axis No.1 of the Motion CPU (CPU No.4) from PLC CPU (CPU No.1) to 1000.


To self CPU high speed interrupt accept flag from CPU U3E3 \G48.0
Speed changing flag of the axis No.1 (CPU No.4) U3E3 \G518.0
M100
SP.CHGV
H3E3
"J1"
K1000
M0
D0
RST
M100
M0
M1
Normal complete program
M1
Abnormal complete program

5.6 Torque Limit Value Change Request Instruction from The PLC CPU to The Motion CPU: S(P).CHGT (PLC instruction: S(P).CHGT)

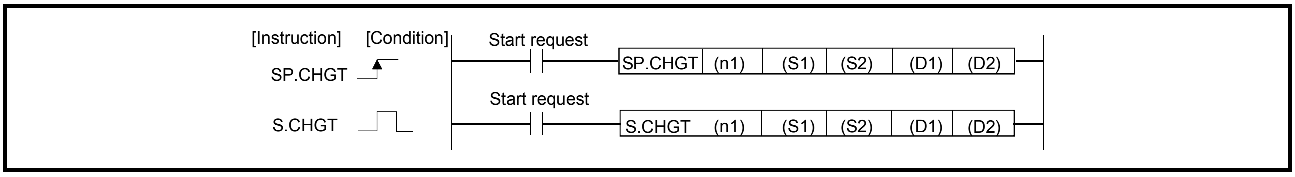
Refer to Section "1.3.4" for the applicable version of the Motion CPU and the software.

- Torque limit value change request instruction from the PLC CPU to the Motion CPU (S(P).CHGT)

Setting data (Note)	Usable devices										
	Internal devices (System, User)		File register	Bit digit specified	Indirectly specified device	MELSECNET/10 direct J□\□		Special function module U□\G□	Index register Z□	Constant K, H	Other
	Bit	Word				Bit	Word				
(n1)		○	○	○	○					○	
(S1)		○	○		○						○
(S2)		○	○	○	○					○	
(D1)	○	○	○								
(D2)		○	○		○						

○ : Usable △ : Usable partly

(Note) : Setting data except (S1) : Index qualification possible



[Setting data]

Setting data	Description	Data type
(n1)	(First I/O No. of the target CPU)/16 Value to specify actually is the following. (Note-1) CPU No.2 : 3E1H, CPU No.3 : 3E2H, CPU No.4 : 3E3H	16-bit binary
(S1)	Axis No. ("Jn") (Note-2) to execute the torque limit value change. Q173CPU(N) : J1 to J32/Q172CPU(N) : J1 to J8	Character sequence
(S2)	Setting of the torque limit value change to change.	16-bit binary
(D1)	Complete devices (D1+0) : Device which make turn on for one scan at start accept completion of instruction. (D1+1) : Device which make turn on for one scan at start accept abnormal completion of instruction. ("D1+0" also turns on at the abnormal completion.)	Bit
(D2)	Device to store the complete status.	16-bit binary

(Note-1) : Motion CPU cannot used CPU No.1 in the Multiple CPU configuration.

(Note-2) : "n" shows the numerical value which correspond to axis No..
Q173CPU(N) : Axis No.1 to No.32 (n=1 to 32) / Q172CPU(N) : Axis No.1 to No.8 (n=1 to 8)

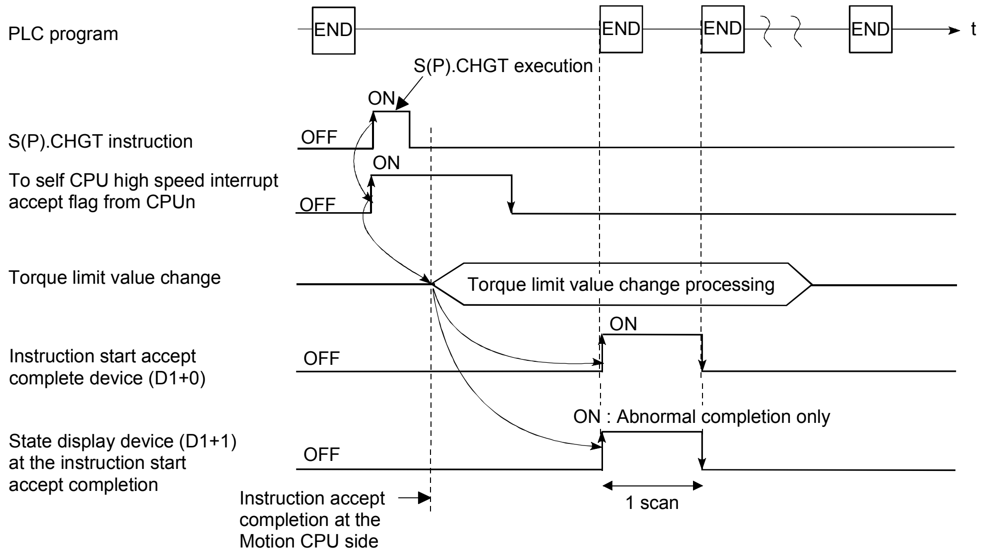
[Controls]

(1) This instruction is dedicated instruction toward the Motion CPU in the Multiple CPU system. Errors occurs when it was executed toward the CPU except the Motion CPU.

(2) The torque limit value of the axis specified with (S1) is changed to the value of (S2) regardless of the state of during operating or stopping at the real mode.

(3) S(P).SFCS/S(P).SVST/S(P).CHGA/S(P).CHGV/S(P).CHGT/S(P).DDRD/ S(P).DDWR cannot be executed simultaneously toward the CPU executing S(P).CHGT instruction.
When the Motion dedicated PLC instruction is started continuously, It is necessary to take an inter-lock by the to self CPU high speed interrupt accept flag from CPUn.

[Operation]


PLC program
END
END
END
END
t
S(P).CHGT execution
ON
S(P).CHGT instruction
OFF
ON
To self CPU high speed interrupt accept flag from CPUn
OFF
Torque limit value change
Torque limit value change processing
ON
Instruction start accept complete device (D1+0)
OFF
ON : Abnormal completion only
State display device (D1+1) at the instruction start accept completion
OFF
Instruction accept completion at the Motion CPU side
1 scan

[Setting range]

(1) Setting of the axis to execute the torque limit value change.
The axis to execute the torque limit change set as (S1) sets J + axis No. in a character sequence " ".

	(S1) usable range
Q173CPU(N)	1 to 32
Q172CPU(N)	1 to 8

The number of axes which can set are only 1 axis.
The axis No. set in the system setting (Refer to Section 1.5) is used as the axis No. to start.

(2) Setting of the torque limit value to change.

(S2) usable range
1 to 500

[Errors]

The abnormal completion in the case shown below, and the error code is stored in the device specified with the complete status storing device (D2).

Complete status (Note) (Error code)(H)	Error factor	Corrective action
4C00	The specified device cannot be used in the Motion CPU. Or, it is outside the device range.	Confirm a program, and correct it to a correct PLC program.
4C01	The instruction for the Multiple CPU system which did not be correspond with operating system software of the Motion CPU was executed.	
4C07	Axis No. set by CHGT instruction is injustice.	
4C09	CPU No. of the instruction cause is injustice.	

(Note) : 0000H (Normal)

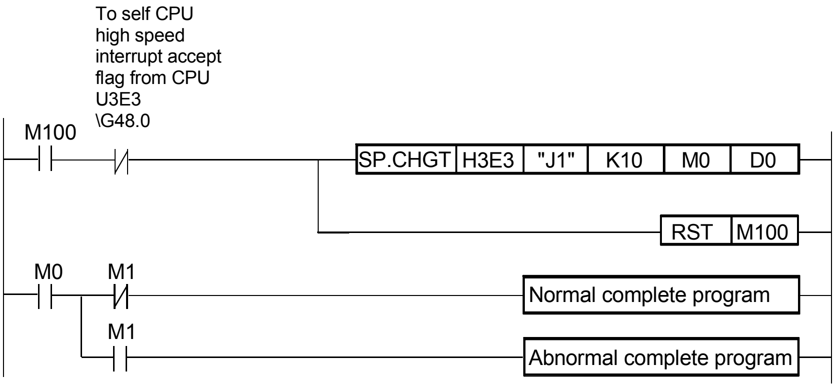
The error flag (SM0) is turned on an operation error in the case shown below, and an error code is stored in SD0.

Error code (Note)	Error factor	Corrective action
2110	The CPU No. to be set by "(First I/O No. of the target CPU)/16" is specified.	Confirm a program, and correct it to a correct PLC program.
2114	The self CPU by "(First I/O No. of the target CPU)/16" is specified.	
2117	The CPU except the Motion CPU by "(First I/O No. of the target CPU)/16" is specified.	
4004	The instruction is composed of devices except usable devices.	
4100	Since 0 to 3DFH, 3E4H by "(First I/O No. of the target CPU)/16" is specified.	

(Note) : 0000H (Normal)

[Program example]

Program which changes the torque limit value of the axis No.1 of the Motion CPU (CPU No.4) from PLC CPU (CPU No.1) to 10[%].



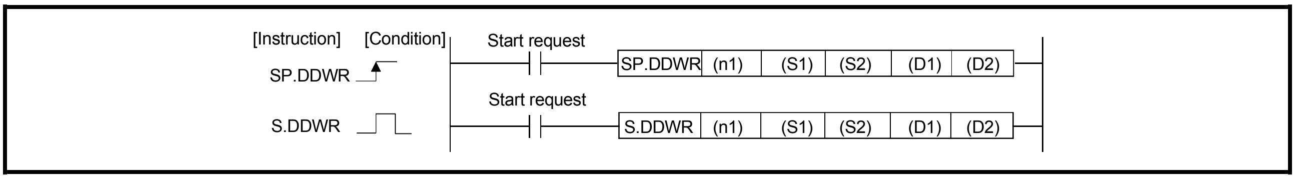
5.7 Write from The PLC CPU to The Motion CPU: S(P).DDWR (PLC instruction: S(P).DDWR)

- Write instruction from the PLC CPU to the Motion CPU (S(P).DDWR)

Setting data (Note)	Usable devices										
	Internal devices (System, User)		File register	Bit digit specified	Indirectly specified device	MELSECNET/10 direct J□\□		Special function module U□\G□	Index register Z□	Constant K, H	Other
	Bit	Word				Bit	Word				
(n1)		○	○	○	○					○	
(S1)		○	○		○						
(S2)		○	○	△	○						
(D1)		○		△	○						
(D2)	○	○	○								

○ : Usable △ : Usable partly

(Note) : Setting data (n1) to (D2) : Index qualification possible



[Setting data]

Setting data	Description	Data type
(n1)	(First I/O No. of the target CPU)/16 Value to specify actually is the following. (Note-1) CPU No.1 : 3E0H, CPU No.2 : 3E1H, CPU No.3 : 3E2H, CPU No.4 : 3E3H	16-bit binary
(S1)	First device of the self CPU in which control data is stored.	16-bit binary
(S2)	First device of the self CPU in which writing data is stored.	
(D1)	First device of the target Motion CPU which stores the writing data.	
(D2)	Bit device which make turn on for one scan at completion of instruction.	Bit

(Note-1) : Motion CPU cannot used CPU No.1 in the Multiple CPU configuration.

[Control data]

Device	Item	Setting data	Setting range	Set by
S1+0	Complete status	The condition result at the completion of the instruction is stored. 0 : No error (Normal completion) Except 0 : Error code	—	System
S1+1	Number of writing data	Set the number of writing data	1 to 16	User

[Controls]

(1) This instruction is dedicated instruction toward the Motion CPU in the Multiple CPU system. Errors occurs when it was executed toward the CPU except the Motion CPU.
A part for the number of writing data of the control data specified with (S1) of data since the device specified with (S2) of the self CPU are stored to since the word device specified with (D1) of the target CPU (n1) in the Multiple CPU system.

(2) Figure specification of the bit device is possible for (S2) and (D1). However, figure specification is 4 figures and a start bit device number is only the multiple of 16. It becomes INSTRCT CODE ERROR [4004] when other values are specified.

(3) If the target CPU is not instruction acceptable condition, even if the S(P).DDWR instruction is executed, it may not be processed. In this case, it is necessary to execute the S(P).DDWR instruction again.
(S(P).SFCS/S(P).SVST/S(P).CHGA/S(P).CHGV/S(P).CHGT/S(P).DDRD/ S(P).DDWR cannot be executed simultaneously toward the CPU executing S(P).DDWR instruction.). It can be confirmed by data in the shared CPU memory of the target CPU (Motion CPU) whether the instruction is acceptable or not.
When the Motion dedicated PLC instruction is started continuously, it is must be design to execute next instruction after executing instruction complete device on.

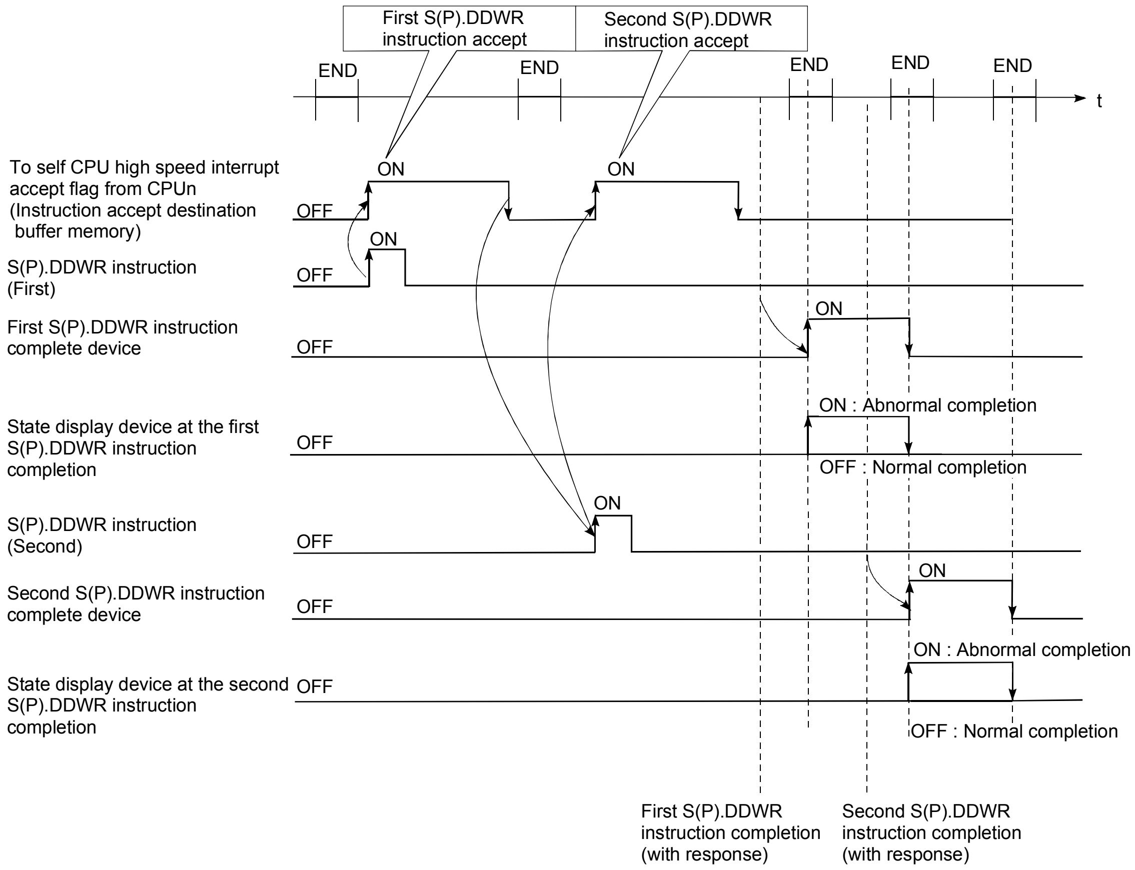
(4) The target CPU device range check is not executed with self CPU at the S(P).DDWR instruction execution, but it checks by the target CPU side, and it becomes abnormal completion at the device range over.

(5) S(P).DDWR instruction accepting and normal/abnormal completion can be confirmed with the complete device (D1) or status display device (D2) at the completion.
(a) Complete device
It is turned on by the END processing of scan which the instruction completed, and turned off by the next END processing.

(b) Status display device at the completion
It is turned on/off according to the status of the instruction completion.
● Normal completion : OFF
● Abnormal completion : It is turned on by the END processing of scan which the instruction completed, and turned off by the next END processing.

(6) SM390 turns on when the target CPU specified with (n1) complete to accept.
SM390 turns off when the target CPU specified with (n1) cannot be write correctly by the reset status or error factor (5000 to 5999).

[Operation of the self CPU at execution of S(P).DDWR instruction]


First S(P).DDWR instruction accept
Second S(P).DDWR instruction accept
END
END
END
END
END
t
To self CPU high speed interrupt accept flag from CPUn (Instruction accept destination buffer memory)
ON
ON
OFF
S(P).DDWR instruction (First)
ON
OFF
First S(P).DDWR instruction complete device
OFF
ON
State display device at the first S(P).DDWR instruction completion
OFF
ON : Abnormal completion
OFF : Normal completion
S(P).DDWR instruction (Second)
ON
OFF
Second S(P).DDWR instruction complete device
OFF
ON
State display device at the second S(P).DDWR instruction completion
OFF
ON : Abnormal completion
OFF : Normal completion
First S(P).DDWR instruction completion (with response)
Second S(P).DDWR instruction completion (with response)

[Errors]

The abnormal completion in the case shown below, and the error code is stored in the control data (S1+ 0 : Complete status).

Complete status (Note) (Error code)(H)	Error factor	Corrective action
4C00	The specified device cannot be used with the Motion CPU. Or, it is outside the device range.	Confirm a program, and correct it to a correct PLC program.
4C08	There are 33 or more instruction requests to the Motion CPU from the PLC CPU in S(P).DDRD/S(P).DDWR sum table simultaneously, and the Motion CPU cannot process them.	
4C09	CPU No. of the instruction cause is injustice.	

(Note) : 0000H (Normal)

The error flag (SM0) is turned on an operation error in the case shown below, and an error code is stored in SD0.

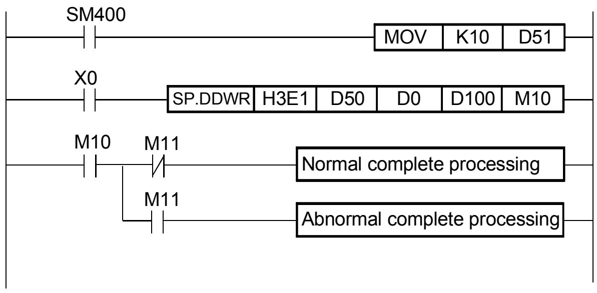
Error code (Note)	Error factor	Corrective action
2110	The CPU No. to be set by "(First I/O No. of the target CPU)/16" is specified.	Confirm a program, and correct it to a correct PLC program.
2114	The self CPU by "(First I/O No. of the target CPU)/16" is specified.	
2117	The CPU except the Motion CPU by "(First I/O No. of the target CPU)/16" is specified.	
4002	Specified instruction is wrong.	
4004	The instruction is composed of devices except usable devices.	
4100	Since 0 to 3DFH, 3E4H is specified by "(First I/O No. of the target CPU)/16" is specified.	
4101	Number of the writing data is except 1 to 16.	
	Number of writing data exceeds range of the storage device of the written data.	

(Note) : 0000H (Normal)

[Program example]

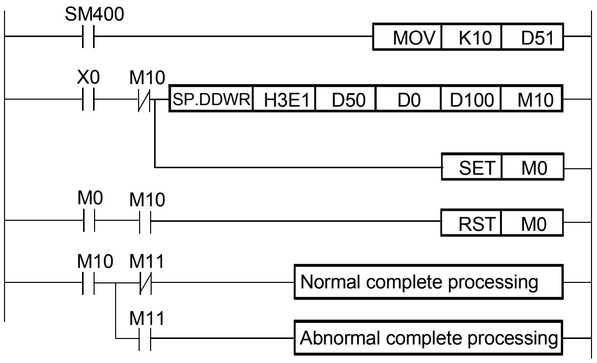
<Example 1>

Program which stores 10 points worth of the data from D0 of the self CPU (CPU No.1) since D100 of CPU No.2., when X0 is turned on.


SM400
MOV K10 D51
X0
SP.DDWR H3E1 D50 D0 D100 M10
M10 M11
Normal complete processing
M11
Abnormal complete processing

<Example 2>

Program which stores 10 points worth of the data from D0 of the self CPU (CPU No.1) since D100 of CPU No.2. during turn on X0.


SM400
MOV K10 D51
X0 M10
SP.DDWR H3E1 D50 D0 D100 M10
SET M0
M0 M10
RST M0
M10 M11
Normal complete processing
M11
Abnormal complete processing

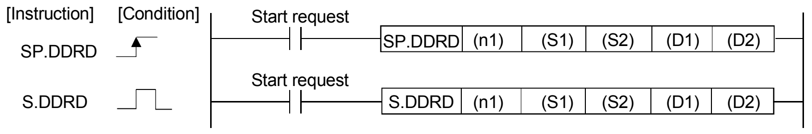
5.8 Read from The Devices of The Motion CPU: S(P).DDRD (PLC instruction: S(P).DDRD)

- Read instruction from the devices of the Motion CPU : S(P).DDRD

Setting data (Note)	Usable devices										
	Internal devices (System, User)		File register	Bit digit specified	Indirectly specified device	MELSECNET/10 direct J□\□		Special function module U□\G□	Index register Z□	Constant K, H	Other
	Bit	Word				Bit	Word				
(n1)		○	○	○	○					○	
(S1)		○	○		○						
(S2)		○		△	○						
(D1)		○	○	△	○						
(D2)	○	○	○								

○ : Usable △ : Usable partly

(Note) : Setting data (n1) to (D2) : Index qualification possible


[Instruction]
[Condition]
SP.DDRD
S.DDRD
Start request
SP.DDRD (n1) (S1) (S2) (D1) (D2)
Start request
S.DDRD (n1) (S1) (S2) (D1) (D2)

[Setting data]

Setting data	Description	Data type
(n1)	(First I/O No. of the target CPU)/16 Value to specify actually is the following. (Note-1) CPU No.1 : 3E0H, CPU No.2 : 3E1H, CPU No.3 : 3E2H, CPU No.4 : 3E3H	16-bit binary
(S1)	First device of the self CPU in which control data is stored.	
(S2)	First device of the target CPU in which reading data is stored.	
(D1)	First device of the self CPU which stores the reading data.	
(D2)	Bit device which make turn on for one scan at completion of instruction.	Bit

(Note-1) : Motion CPU cannot used CPU No.1 in the Multiple CPU configuration.

[Control data]

Device	Item	Setting data	Setting range	Set by
S1+0	Complete status	The condition result at the completion of the instruction is stored. 0 : No error (Normal completion) Except 0 : Error code	—	System
S1+1	Number of reading data	Set the number of reading data.	1 to 16	User

[Controls]

(1) This instruction is dedicated instruction toward the Motion CPU in the Multiple CPU system. Errors occurs when it was executed toward the CPU except the Motion CPU.
A part for the number of reading data of the control data specified with (S1) of data since the device specified with (S2) in the target CPU (n1) is stored to since the word device specified with (D1) of the self CPU in the Multiple CPU system.

(2) Figure specification of the bit device is possible for (S2) and (D1). However, figure specification is 4 figures and a start bit device number is only the multiple of 16. It becomes INSTRCT CODE ERROR [4004] when other values are specified.

(3) If the target CPU is not instruction acceptable condition, even if the S(P).DDWR instruction is executed, it may not be processed. In this case, it is necessary to execute the S(P).DDWR instruction again.
(S(P).SFCS/S(P).SVST/S(P).CHGA/S(P).CHGV/S(P).CHGT/S(P).DDRD/ S(P).DDWR cannot be executed simultaneously toward the CPU executing S(P).DDWR instruction.). It can be confirmed by data in the shared CPU memory of the target CPU (Motion CPU) whether the instruction is acceptable or not.
When the Motion dedicated PLC instruction is started continuously, it is must be design to execute next instruction after executing instruction complete device on.

(4) The target CPU device range check is not executed with self CPU at the S(P).DDRD instruction execution, but it checks by the target CPU side, and it becomes abnormal completion at the device range over.

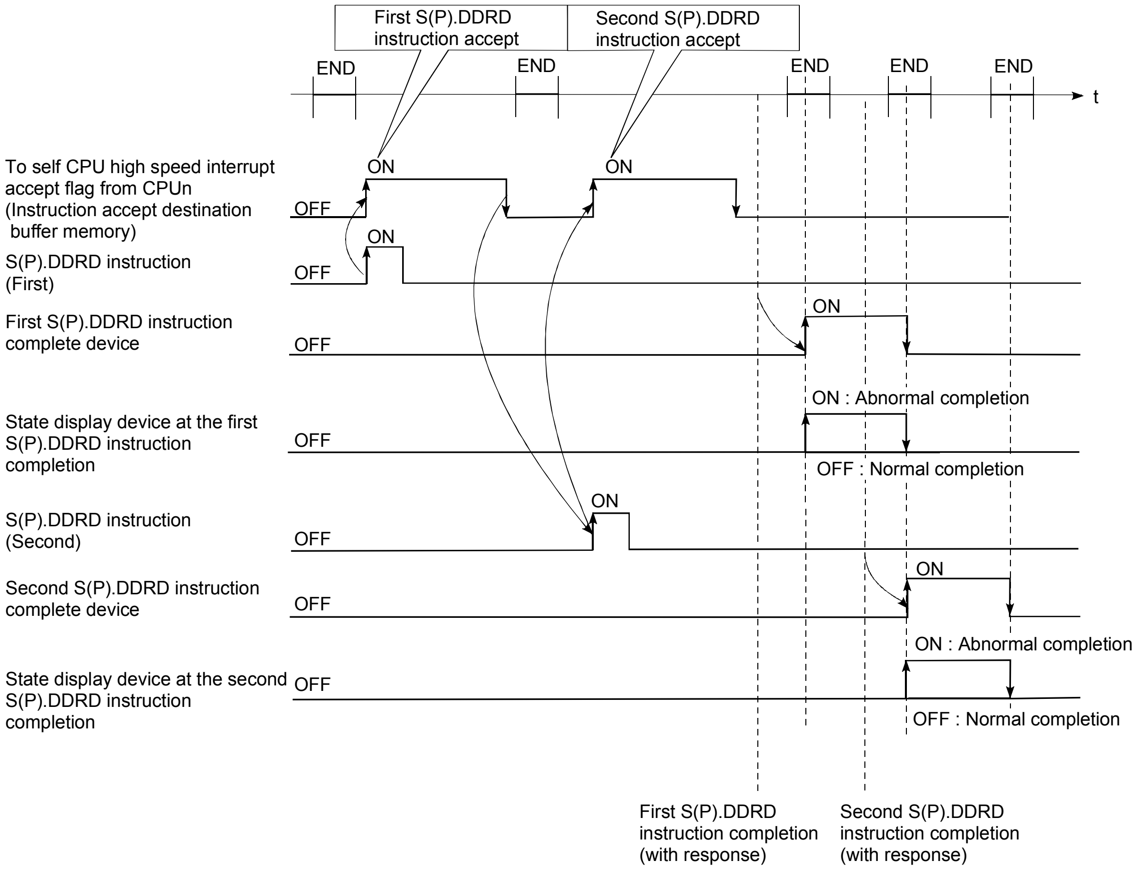
(5) S(P).DDRD instruction accepting and normal/abnormal completion can be confirmed with the complete device (D1) or status display device (D2) at the completion.

(a) Complete device
It is turned on by the END processing of scan which the instruction completed, and turned off by the next END processing.

(b) Status display device at the completion
It is turned on/off according to the status of the instruction completion.
- ● Normal completion : OFF
- ● Abnormal completion : It is turned on by the END processing of scan which the instruction completed, and turned off by the next END processing.

(6) SM390 turns on when the target CPU specified with (n1) complete to accept.
SM390 turns off when the target CPU specified with (n1) cannot be write correctly by the reset status or error factor (5000 to 5999).

[Operation of the self CPU at execution of S(P).DDRD instruction]


First S(P).DDRD instruction accept
Second S(P).DDRD instruction accept
END
END
END
END
END
t
To self CPU high speed interrupt accept flag from CPUn (Instruction accept destination buffer memory)
S(P).DDRD instruction (First)
First S(P).DDRD instruction complete device
State display device at the first S(P).DDRD instruction completion
S(P).DDRD instruction (Second)
Second S(P).DDRD instruction complete device
State display device at the second S(P).DDRD instruction completion
ON
OFF
ON : Abnormal completion
OFF : Normal completion
First S(P).DDRD instruction completion (with response)
Second S(P).DDRD instruction completion (with response)

[Errors]

The abnormal completion in the case shown below, and the error code is stored in the control data (S1+ 0 : Complete status).

Complete status (Note) (Error code)(H)	Error factor	Corrective action
4C00	The specified device cannot be used in the Motion CPU. Or, it is outside the device range.	Confirm a program, and correct it to a correct PLC program.
4C08	There are 33 or more instruction requests to the Motion CPU from the PLC CPU in S(P).DDRD/S(P).DDWR sum table simultaneously, and the Motion CPU cannot process them.	
4C09	CPU No. of the instruction cause is injustice.	

(Note) : 0000H (Normal)

The error flag (SM0) is turned on an operation error in the case shown below, and an error code is stored in SD0.

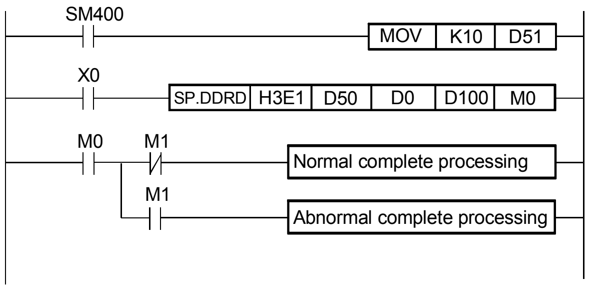
Error code (Note)	Error factor	Corrective action
2110	The CPU No. to be set by "(First I/O No. of the target CPU)/16" is specified.	Confirm a program, and correct it to a correct PLC program.
2114	The self CPU by "(First I/O No. of the target CPU)/16" is specified.	
2117	The CPU except the Motion CPU by "(First I/O No. of the target CPU)/16" is specified.	
4002	Specified instruction is wrong.	
4004	The instruction is composed of devices except usable devices.	
4100	Since 0 to 3DFH, 3E4H is specified by "(First I/O No. of the target CPU)/16" is specified.	
4101	Number of the writing data is except 1 to 16.	
	Number of writing data exceeds range of the storage device of the written data.	

(Note) : 0000H (Normal)

[Program example]

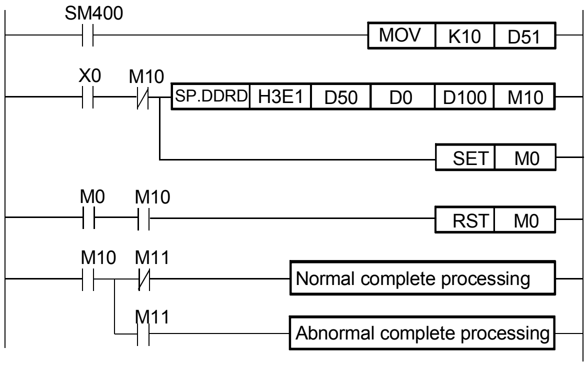
<Example 1>

Program which stores 10 points worth of the data from D0 of the CPU since D100 of self CPU (CPU No.1), when X0 is turned on.



<Example 2>

Program stores 10 points worth of the data from D0 of the CPU No.2 since D100 of self CPU (CPU No.1) during turn on X0..



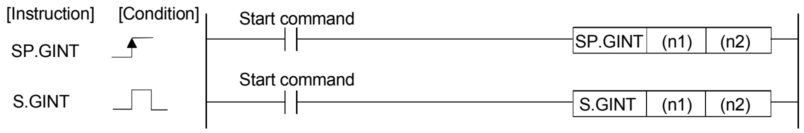
5.9 Interrupt Instruction to The Other CPU: S(P).GINT (PLC instruction: S(P).GINT)

- Interrupt instruction to the other CPU (S(P).GINT)

Setting data (Note)	Usable devices										
	Internal devices (System, User)		File register	Bit Digit specified	Indirectly specified device	MELSECNET/10 direct J□\□		Special function module U□\G□	Index register Z□	Constant K, H	Other
	Bit	Word				Bit	Word				
(n1)		○	○	○	○					○	
(n2)		○	○	○	○					○	

○ : Usable △ : Usable partly

(Note) : Setting data (n1) to (D2) : Index qualification possible



[Setting data]

Setting data	Description	Data type
(n1)	(First I/O No. of the target CPU)/16 Value to specify actually is the following. (Note-1) CPU No.1 : 3E0H, CPU No.2 : 3E1H, CPU No.3 : 3E2H, CPU No.4 : 3E3H	16-bit binary
(n2)	Interrupt instruction No. (0 to 15)	16-bit binary

(Note-1) : Motion CPU cannot used CPU No.1 in the Multiple CPU configuration.

[Controls]

This instruction generates the interrupt to the Motion CPU by PLC program when the execution instruction of S(P).GINT is started (OFF → ON).
The Motion CPU executes the active program (operation program status) processing of the Motion SFC program set by "PLC interruption of the event task" at the interrupt generation from the PLC CPU.

(1) This instruction is always effective regardless of the state of real mode/virtual mode/mode switching when the operating system software of Motion CPU is SV22.

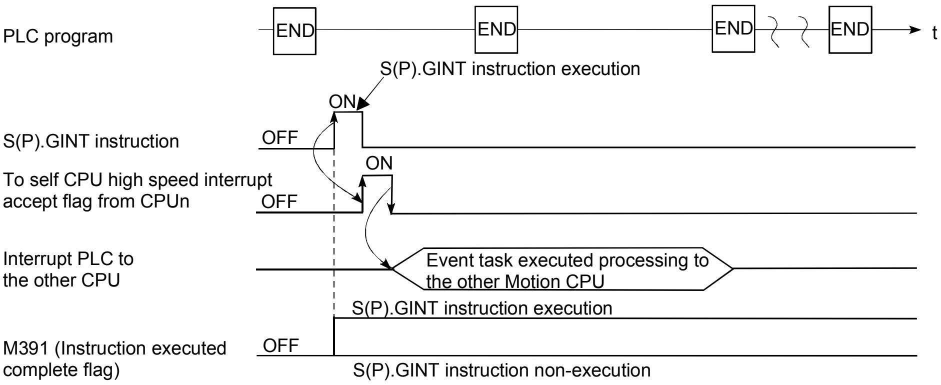
(2) Motion CPU side is during DI (interrupt disable), event processing can make wait even as for the EI (interrupt enable) instruction execution.

(3) SM390 turn on when the transmission of the instruction toward the target CPU was completed. SM391 (S(P).GINT instruction execution completion flag) turned on simultaneously.

(4) SM390 turn off when the transmission of the instruction toward the target CPU was not completed. SM391 (S(P).GINT instruction execution completion flag) turned off when the instruction toward the target CPU cannot be transmitted.

(5) Number of instruction execution does not have restriction, if to self CPU high speed interrupt accept flag from CPUn in the target shared CPU memory of S(P).GINT instruction.

[Operation]


PLC program
END
END
END
END
t
S(P).GINT instruction execution
ON
S(P).GINT instruction
OFF
ON
To self CPU high speed interrupt accept flag from CPUn
OFF
Interrupt PLC to the other CPU
Event task executed processing to the other Motion CPU
S(P).GINT instruction execution
M391 (Instruction executed complete flag)
OFF
S(P).GINT instruction non-execution

[Errors]

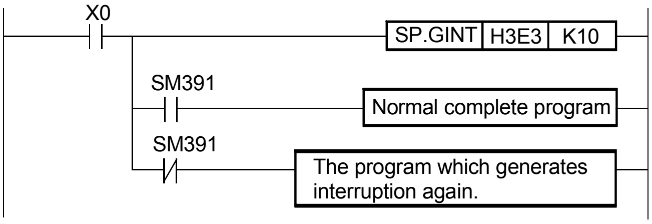
The error flag (SM0) is turned on an operation error in the case shown below, and an error code is stored in SD0.

Complete status (Note) (Error code)(H)	Error factor	Corrective action
2110	The CPU No. to be set by "(First I/O No. of the target CPU)/16" is specified.	Confirm a program, and correct it to a correct PLC program.
2114	The self CPU by "(First I/O No. of the target CPU)/16" is specified.	
2117	The CPU except the Motion CPU by "(First I/O No. of the target CPU)/16" is specified.	
4100	Since 0 to 3DFH, 3E4H is specified by "(First I/O No. of the target CPU)/16" is specified.	
4C08	There are 33 or more instruction requests to the Motion CPU from the PLC CPU in S(P).SFCS/S(P).SVST/ S(P).CHGA/S(P).GINT sum table simultaneously, and the Motion CPU cannot process them.	

(Note) : 0000H (Normal)

[Program example]

Program which generates the interrupt toward the Motion CPU No.4.



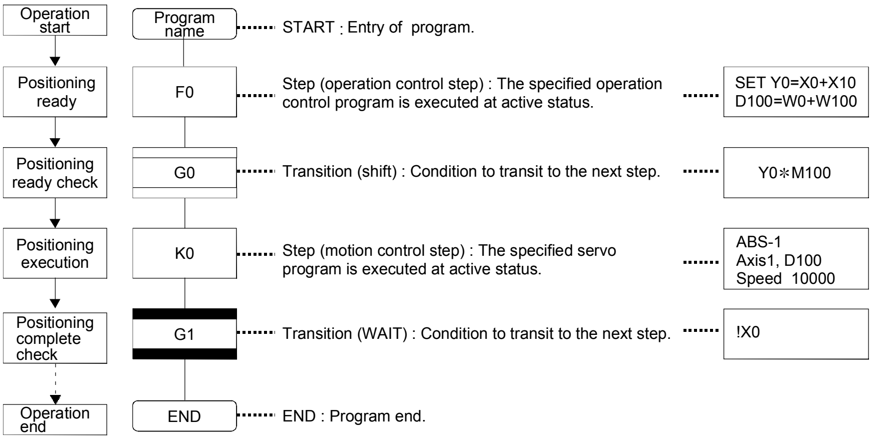
MEMO

6. MOTION SFC PROGRAMS

Refer to Chapter "19 ERROR CODE LISTS" for details of Motion SFC program error.

6.1 Motion SFC Program Configuration

The Motion SFC Program is constituted by the combination of start, steps, transitions, end and others are shows below.


Operation start
Program name
START : Entry of program.
Positioning ready
F0
Step (operation control step) : The specified operation control program is executed at active status.
SET Y0=X0+X10
D100=W0+W100
Positioning ready check
G0
Transition (shift) : Condition to transit to the next step.
Y0✻M100
Positioning execution
K0
Step (motion control step) : The specified servo program is executed at active status.
ABS-1
Axis1, D100
Speed 10000
Positioning complete check
G1
Transition (WAIT) : Condition to transit to the next step.
!X0
Operation end
END
END : Program end.

The above Motion SFC program to be started performs the following operations.

(1) The step (F0) is activated and the operation specified with the step (F0) is executed (positioning ready). A step in such an active state is called an active step.

(2) Whether the condition specified with the transition (G0) has enabled or not (whether the positioning program can be started or not) is checked. The active step (F0) is deactivated at the completion of condition and the next step (K0) is activated (servo program (K0) is started).

(3) The operating completion of the step (K0) (positioning completion of the servo program K0) is checked, and control transits to the next step at operating completion (completion of condition).

(4) With the transition of the active step as described in above (1) to (3), control is executed and ends at END.

Refer to Section "11.2.2 Task operation" for details of the execution timing of the Motion SFC program such as above.

POINT

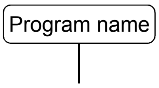
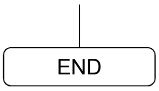
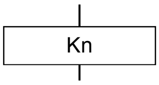
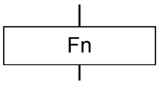
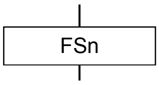
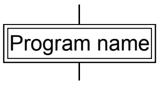
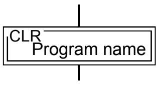
The number of steps which can be active steps simultaneously is up to 256, with those of all Motion SFC programs combined. Excess of 256 will result in the Motion SFC Program error 16120.

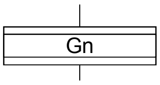
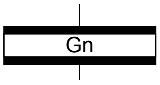
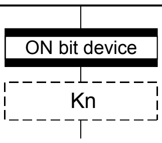
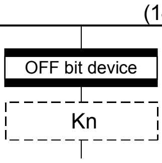
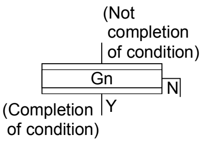
Each symbol of the Motion SFC program is as follows.

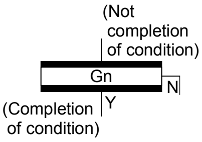
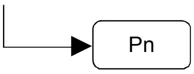
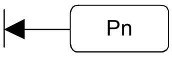
F/FS : Operation control, K : Positioning control, G : Judgment

6.2 Motion SFC Chart Symbol List

Parts as Motion SFC program components are shown below. The operation sequence or transition control is expressed with connecting these parts by directed lines in the Motion SFC program.

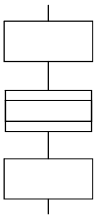
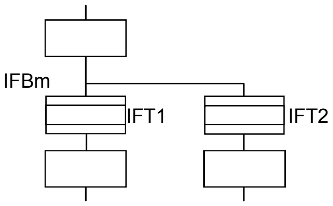
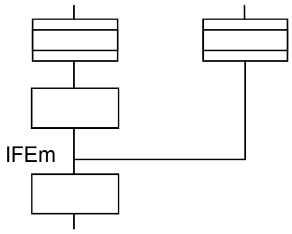
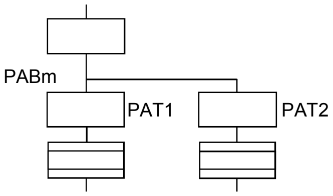
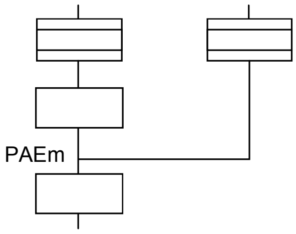
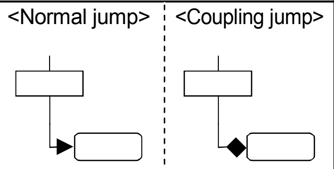
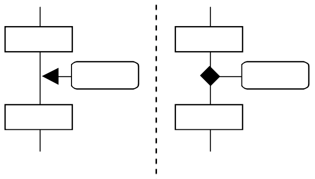
Classification	Name	Symbol (Code size (byte))	List Representation	Function
Program start/end	START	 (0)	Program name	• Indicates an entry of program as a program name. • Specify this program name at a subroutine call. • Only one program name for one program.
	END	 (8)	END	• Indicates an end (exit) of program. • When a subroutine call was carried out, returns to the call source program. • Multiple program names or no symbols for one program.
Step	Motion control step	 (8)	CALL Kn	• Starts a servo program Kn (K0 to K4095).
	Once execution type operation control step	 (8)	CALL Fn	• Execute once the operation control program Fn (F0 to F4095).
	Scan execution type operation control step	 (8)	CALL FSn	• Repeats an operation control program FSn (FS0 to FS4095) until the next transition condition enables.
	Subroutine call/start step	 (8)	GSUB program name	• When the next of GSUB is WAIT, performs "subroutine call" and transits control to the specified program. Control returns to the call source program at END execution. • When the next of GSUB is except WAIT, performs "subroutine start", and starts the specified program and transits to the next (lower part). The start source and destination programs are executed simultaneously, and the call destination program ends at END execution.
	Clear step	 (8)	CLR program name	• Stops and ends the specified program running. After an end, it is started from the initial (start step) by restarting the program. • When the specified program is during "subroutine call", the subroutine program is also stopped to execute. • When the specified program is after "subroutine start", the subroutine program is not stopped to execute. • When clearing to the subroutine by which the "subroutine call" was executed, the specified subroutine is stopped to execute, returns to the call source program, and transits to the next.

Classification	Name	Symbol (Code size (byte))	List representation	Function
Transition	Shift (Pre-read transition)	 (8)	SFT Gn	• When just before is the motion control step, transits to the next step by formation of transition condition Gn (G0 to G4095) without waiting for the motion operating completion. • When just before is the operation control step, transits to the next step by the completion of transition condition after operating execution. • When just before is "subroutine call" / "starting step", transits to the next step by formation of transition condition without waiting for the operating completion of subroutine.
	WAIT	 (8)	WAIT Gn	• When just before is the motion control step, waits for the motion operating completion and then transits to the next step by the completion of transition condition Gn (G0 to G4095). • When just before is the operation control step, transits to the next step by formation of transition condition after operating execution. (Same operation as Shift.) • When just before is "subroutine call" or "starting step", waits for the operating completion of subroutine and then transits to the next step by the completion of transition condition.
	WAITON	 (14)	WAITON bit device	• Prepares for starting of the next motion control step, and issues an instruction immediately when the specified bit device turns ON. • Always pair this transition with the motion control step one-for-one.
	WAITOFF	 (14)	WAITOFF bit device	• Prepares for starting of the next motion control step, and issues an instruction immediately when the specified bit device turns OFF. • Always pair this transition with the motion control step one-for-one.
	Shift Y/N	 (Not completion of condition) Gn N (Completion of condition) Y	IFBm IFT1 SFT Gn : JMP IFEm IFT2 SFT Gn+? : JMP IFEm IFEm	• When just before is the motion control step, transits to the next step by formation of transition condition Gn (G0 to G4095) without waiting for the motion operating completion. If not formation of transition condition, transits to the right-connected step. • When just before is the operation control step, transits to the next step by the completion of transition condition after operating execution. If not the completion of transition condition, transits to the right-connected step. • When just before is "subroutine call" or "starting step", transits to the next step by the completion of transition condition without waiting for the operating of subroutine completion. If not formation of transition condition, transits to the right-connected step.

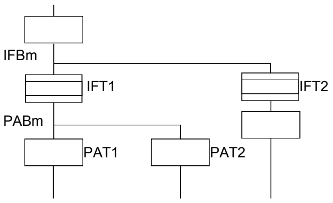
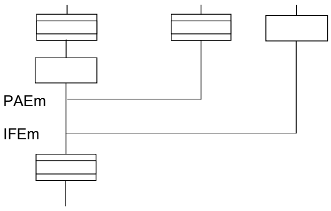
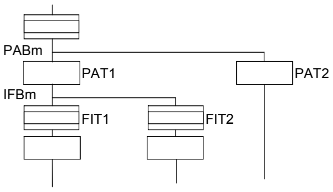
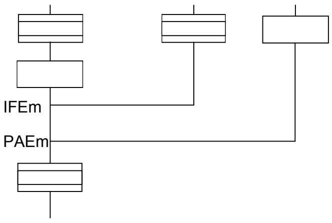
Classification	Name	Symbol (Code size (byte))	List representation	Function
Transition	WAIT Y/N	 (Not completion of condition) Gn N (Completion of condition) Y	IFBm IFT1 WAIT Gn : JMP IFEm IFT2 WAIT Gn+? : JMP IFEm IFEm	• When just before is the motion control step, waits for the motion operating completion and then transits to the next step by formation of transition condition Gn (G0 to G4095). If not completion of transition condition, transits to the right-connected step. • When just before is the operation control step, transits to the next step by the completion of transition condition after operating execution. If not the completion of transition condition, transits to the right-connected step. (Same operation as Shift.) • When just before is "subroutine call" or "starting step", waits for the operating completion of subroutine, and then transits to the next step by the completion of transition condition. If not formation of transition condition, transits to the right-connected step.
Jump	Jump	 (14)	JMP Pn	• Jumps to the specified pointer Pn (P0 to P16383) of the self program.
Pointer	Pointer	 (8)	Pn	• Indicates a jump destination pointer (label). • This pointer can be set at a step, transition, branch point or coupling point. • P0 to P16383 can be set in one program. The same No. may also be used in other programs.

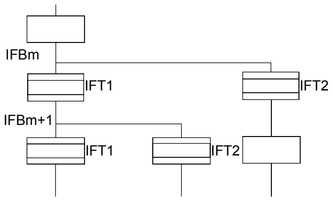
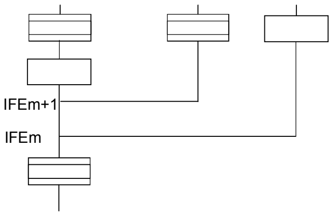
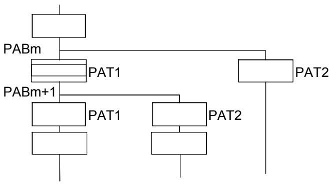
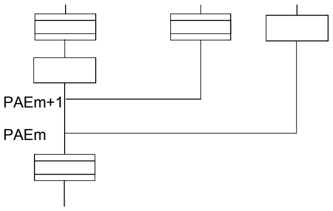
6.3 Branch and Coupling Chart List

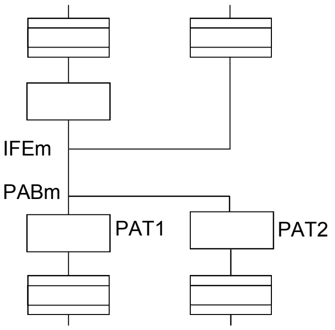
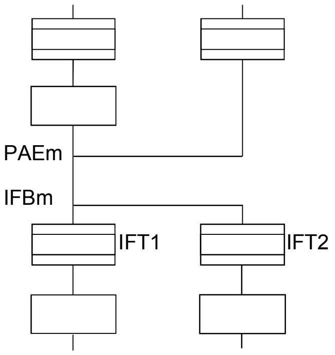
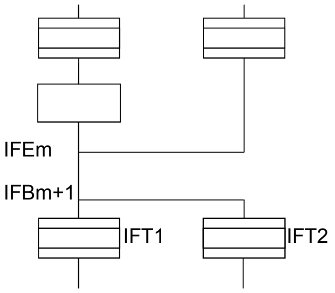
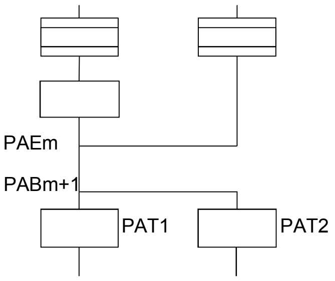
Branch and coupling patterns which specify step and transition sequences in the Motion SFC charts are shown below.

	Name (Code size (byte))	Motion SFC chart symbol	List representation	Function
Basic type	Series transition (Corresponding symbol size)		List representation corresponding to the Motion SFC chart symbols shown in Section 6.2.	• Steps and transitions connected in series are processed in order from top to bottom. • Steps and transitions need not be lined up alternately. • When a transition is omitted, unconditional shift processing is performed.
	Selective branch ((Number of branches + 2) × 10)		CALL Kn IFBm IFT1 SFT Gn CALL Fn : JMP IFEm IFT2 SFT Gn' CALL Fn' : (JMP IFEm) IFEm CALL Fn''	• The route which transition condition enables first is executed after executing the step or transition preceding a branch. • Selective branch destinations should always be started by transitions, all of which must be Shift or WAIT. (Using Shift and WAIT together will cause a parallel branch.)
	Selective coupling (8)			• After the route branched by a selective branch has been processed, execution shifts to a coupling point. • A coupling may be preceded and followed by either a step or a transition.
	Parallel branch (Number of branches × 22 + number of coupling points × 2 + 12)		CALL Kn PABm PAT1 CALL Fn SFT Gn' : JMP PAEm PAT2 CALL Fn' SFT Gn'' : (JMP PAEm) PAEm CALL Fn'' :	• Multiple routes (steps) connected in parallel are executed simultaneously. • Each parallel branch destination may be started by either a step or transition.
	Parallel coupling (8)			• Execution waits at the coupling point for executions of the routes branched by a parallel branch to be completed, and shifts to the next when executions of all routes are completed. • A coupling may be preceded and followed by either a step or a transition. • When this coupling is preceded by an FS step, scans are executed during waiting. After waiting is complete, scans are not executed.
	Jump transition (Corresponding symbol size)		CALL Fn JMP Pn	1) Normal jump • After the step or transition preceding this jump transition is executed, execution shifts to the pointer Pn specified within its own program. • The jump destination may either be a step or transition. • When a jump takes place from an FS step to a transition, scans are executed during waiting for the completion of transition condition of the jump destination. 2) Coupling jump • When a jump to the other route within a parallel branch takes place after the parallel branch, a "coupling jump" takes place and execution waits at the jump destination.
			CALL Fn' Pn CALL Kn	

Combining the basic type branches/couplings provides the following application types, which are defined as in the basic types.

	Name	Motion SFC chart symbol	List representation	Function
Appli-cation type	Selective branch | Parallel branch		CALL Kn IFBm IFT1 SFT Gn PABm PAT1 CALL Fn : JMP PAEm PAT2 CALL Fn’ : (JMP PAEm) PAEm JMP IFEm IFT2 SFT Gn’ CALL Fn” : (JMP IFEm) IFEm SFT Gn”	• After a selective branch, a parallel branch can be performed.
	Parallel coupling | Selective coupling			• The selective coupling point can be the same as the coupling point of a parallel coupling for selective branch → parallel branch. Note that in the Motion SFC chart, this type is displayed in order of a parallel coupling → a selective coupling, as shown on the left. • In this case, a pointer (Pn) cannot be set between the parallel coupling point (PAEm) and the selective coupling point (IFEm).
	Parallel branch | Selective branch		SFT Gn PABm PAT1 CALL Fn IFBm IFT1 SFT Gn’ CALL Fn’ : JMP IFEm IFT2 SFT Gn” CALL Fn” : (JMP IFEm) IFEm JMP PAEm PAT2 CALL Fn’” : CALL Kn (JMP PAEm) PAEm SFT Gn’”	• After a parallel branch, a selective branch can be performed.
	Selective coupling | Parallel coupling			• The parallel coupling point can be the same as the coupling point of a selective coupling for parallel branch → selective branch. Note that in the Motion SFC chart, this type is displayed in order of a selective coupling → a parallel coupling, as shown on the left. • In this case, a pointer (Pn) cannot be set between the selective coupling point (IFEm) and the parallel coupling point (PAEm).

	Name	SFC chart symbol	List representation	Function
Application type	Selective branch | Selective branch		CALL Kn IFBm IFT1 SFT Gn IFBm+1 IFT1 SFT Gn’ : JMP IFEm+1 IFT2 SFT Gn” : (JMP IFEm+1) IFEm+1 JMP IFEm IFT2 SFT Gn’” CALL Fn’ : (JMP IFEm) IFEm SFT Gn”” :	• After a selective branch, a selective branch can be performed.
	Selective coupling | Selective coupling			• The two selective coupling points for selective branch → selective branch can be the same. Note that in the Motion SFC chart, this type is displayed in order of a selective coupling→a selective coupling, as shown on the left. • In this case, a pointer (Pn) cannot be set between the selective coupling point (IFEm+1) and the selective coupling point (IFEm).
	Parallel branch | Parallel branch		CALL Kn PABm PAT1 SFT Gn PABm+1 PAT1 CALL Fn’ : JMP PAEm+1 PAT2 CALL Fn” : (JMP PAEm+1) PAEm+1 JMP PAEm PAT2 CALL Fn’” : CALL Kn JMP PAEm PAEm SFT Gn’” :	• After a parallel branch, a parallel branch can be performed. • A parallel branch can be nested up to four levels.
	Parallel coupling | Parallel coupling			• The two parallel coupling points for parallel branch parallel branch can be the same. Note that in the Motion SFC chart, this type is displayed in order of a parallel coupling → a parallel coupling, as shown on the left. • In this case, a pointer (Pn) cannot be set between the parallel coupling point (PAEm+1) and the parallel coupling point (PAEm).

	Name	SFC chart symbol	List representation	Function
Appli-cation type	Selective coupling | Parallel branch		: (JMP IFEm) IFEm PABm PAT1 CALL Fn : JMP PAEm PAT2 CALL Fn' : (JMP PAEm) PAEm :	• The selective coupling point and parallel branch point can be the same. Note that in the Motion SFC chart, this type is displayed in order of a selective coupling → a parallel branch, as shown on the left. • In this case, a pointer (Pn) cannot be set between the selective coupling point (IFEm) and the parallel branch point (PABm).
	Parallel coupling | Selective branch		: JMP PAEm PAEm IFBm IFT1 SFT Gn : JMP IFEm IFT2 SFT Gn' : (JMP IFEm) IFEm :	• The parallel coupling point and selective branch point can be the same. Note that in the Motion SFC chart, this type is displayed in order of a parallel coupling → a selective branch, as shown on the left. • Execution waits at the parallel coupling point and shifts to the selective branch. • In this case, a pointer (Pn) cannot be set between the parallel coupling point (PAEm) and the selective branch point (IFBm).
	Selective coupling | Selective branch		: (JMP IFEm) IFEm IFBm+1 IFT1 SFT Gn : JMP IFEm+1 IFT2 SFT Gn' : (JMP IFEm+1) IFEm+1	• The selective coupling point and selective branch point can be the same. Note that in the Motion SFC chart, this type is displayed in order of a selective coupling → a selective branch, as shown on the left. • In this case, a pointer (Pn) cannot be set between the selective coupling point (IFEm) and the selective branch point (IFBm+1).
	Parallel coupling | Parallel branch		: (JMP PAEm) PAEm PABm+1 PAT1 CALL Fn : JMP PAEm+1 PAT2 CALL Fn' : (JMP PAEm+1) PAEm+1 :	• The parallel coupling point and parallel branch point can be the same. Note that in the Motion SFC chart, this type is displayed in order of a parallel coupling→a parallel branch, as shown on the left. • Execution waits at the parallel coupling point and shifts to the parallel branch. • In this case, a pointer (Pn) cannot be set between the parallel coupling point (PAEm) and the parallel branch point (PABm+1).

6.4 Motion SFC Program Name

Set the "Motion SFC program name" to the Motion SFC program No.0 to No.255 individually. (Make this setting in the "Motion SFC program management window" on the Motion SFC program edit screen.)
Set the Motion SFC program name within 16 characters. Specify this Motion SFC program name for a "subroutine call/start step (GSUB)" and "clear step (CLR)".
Motion SFC programs correspond to No.0 to No.255 and saved in a one program-for-one file format. The preset "Motion SFC program name" is used as the file name of the Motion SFC Program file for user file management. (Refer to Chapter "12 USER FILES" for details.)

POINT

(1) It is can be set the Motion SFC program to any of No.0 to No.255. There are no specific programs which have special roles.
(2) "$" cannot be used in the first character of the Motion SFC program name.
(3) " / : ; , . * ? " < > |" cannot be used in Motion SFC program name.

6.5 Steps

6.5.1 Motion control step

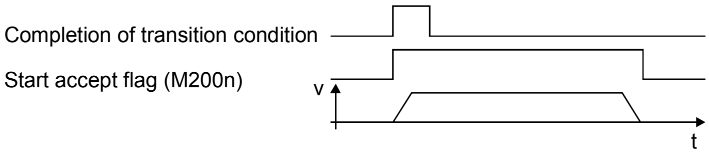
Name	Symbol	Function
Motion control step	Kn	Starts the servo program Kn. Specified range: K0 to K4095

[Operations]

(1) Turns on the start accept flag of the axis specified with the specified servo program Kn (n = 0 to 4095) runnnig.

(2) Starts the specified servo program Kn (n = 0 to 4095).

Execution timing



[Errors]

(1) When the specified servo program Kn does not exist, the Motion SFC program error [16200] will occur and stops to execute the Motion SFC program at the error detection.

[Instructions]

(1) When the current value change is executed in the Motion SFC program running, specify the CHGA instruction in the servo program and call it at the motion control step.

(2) If the servo program has stopped due to a major/minor error which occurred at or during a start of the servo program specified with the motion control step, the Motion SFC program continues executing. When the Motion SFC program is stopped at error detection, provide an error detection condition at the transition (transition condition).

6.5.2 Operation control step

Name	Symbol	Function
Operation control step	Fn/FSn	Executes the operation control program Fn/FSn. Specified range: F0 to F4095/FS0 to FS4095

[Operations]

(1) Once execution type operation control step Fn
In the case of Fn, executes the specified operation control program Fn (n = 0 to 4095) once.

(2) Scan execution type operation control step FSn
In the case of FSn, repeats the specified operation control program FSn (n =0 to 4095) until the next transition condition enables.

[Errors]

(1) When the specified operation control program Fn/FSn does not exist, the Motion SFC program error [16201] will occur and stops to execute the Motion SFC program at the error detection.

[Instructions]

(1) Refer to Chapter "7 OPERATION CONTROL PROGRAMS" for operation expressions that may be described in operation control programs.

(2) If an operation or similar error occurs the operation control program running, the Motion SFC program continues executing.

6.5.3 Subroutine call/start step

Name	Symbol	Function
Subroutine call/start step	Program name	Calls/starts the Motion SFC program of the specified program name.

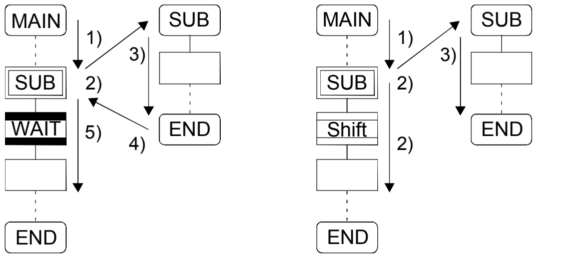
[Operations]

(1) Calls/starts the Motion SFC program of the specified program name.

(2) Control varies with the type of the transition coupled next to the subroutine call/start step.

(a) WAIT (Subroutine Call)
When the subroutine call step is executed, control transits to the specified program as shown below, and when END of the called program is executed, control returns to the call source program.

(b) Except WAIT (Subroutine Start)
When the subroutine start step is executed, control starts the specified program and then shifts to the next as shown below. Since, the start source and destination Motion SFC programs are executed in parallel. The started program ends at END execution.



WAIT (Subroutine call)

Except WAIT (Subroutine start)

[Errors]

(1) When the specified Motion SFC program does not exist at a subroutine call/start, the Motion SFC program error [16005] will occur and stops to execute the Motion SFC program at the error detection.

(2) When the called/started Motion SFC program is already starting at a subroutine call/start, the Motion SFC program error [16006] will occur and stops to execute the Motion SFC program at the error detection.

(3) When the self program is started at a subroutine call/start, the Motion SFC program error [16110] will occur and stops to execute the Motion SFC program at the error detection.

(4) When the subroutine to be called/started at a subroutine call/start in the Motion SFC program 2 running which was called/started from the Motion SFC program 1 is the Motion SFC program 1 (call source/start program), the Motion SFC program error [16111] will occur and the call/start source Motion SFC program 2 running is stopped at the point of error detection.

[Instructions]

(1) There are no restrictions on the depth of subroutine call/start nesting.

(2) For a subroutine start, the start source Motion SFC program continues processing if the start destination Motion SFC program stops due to an error.

(3) For a subroutine call, the call source Motion SFC program stops running as soon as the call destination Motion SFC program stops due to an error.

6.5.4 Clear step

Name	Symbol	Function
Clear step	CLR Program name	Stops the Motion SFC program of the specified program name.

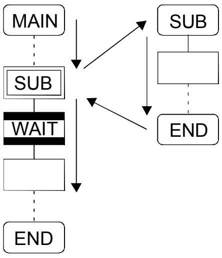
[Operations]

(1) Stops the specified Motion SFC program running.

(2) The clear-specified Motion SFC program will not start automatically after stopped if it has been set to start automatically.

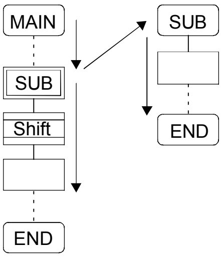
(3) The specified program may be its self program.

(4) If the specified program is being subroutine called, the subroutine program called is also stopped. (Shown below)



If the program has been "subroutine called" as shown on the left
- When the call source program (MAIN) is cleared.
  Even if the subroutine (SUB) is running, both the call source program (MAIN) and subroutine (SUB) stop running.
- When the subroutine (SUB) is running, the subroutine (SUB) stops running and execution to the call source program (MAIN).

(5) When the specified program has been subroutine started, the subroutine program started continues processing. (Shown below)



If the program has been "subroutine started" as shown on the left
- When the started program (MAIN) is cleared.
  Even if the subroutine (SUB) is running, the started program (MAIN) stops running but the started subroutine (SUB) continues processing.
- When the subroutine (SUB) is cleared
  If the subroutine (SUB) is running, only the subroutine (SUB) stops running.

(6) When the servo program started from the specified program is starting, the servo program continues processing.

[Errors]

(1) When the Motion SFC program specified with the clear step does not exist, the Motion SFC program error [16203] will occur.

[Instructions]

(1) When the Motion SFC program specified with the clear step is not starting, an error does not occur specifically and this step is ignored.

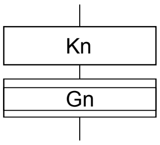
(2) If the Motion SFC program running is stopped by the clear step, the output is held.

6.6 Transitions

You can describe conditional and operation expressions at transitions. The operation expression described here is repeated until the transition condition enables, as at the scan execution type operation step.
Refer to Chapter "8 TRANSITION PROGRAMS" for the conditional/operation expressions that can be described in transition conditions.

(1) Combinations with motion control steps

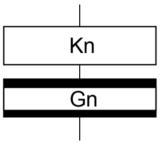
(a) Motion control step + Shift



[Operations]

- Transits to the next step by formation of transition condition Gn without waiting for the operating completion of the servo program Kn started at the motion control step.

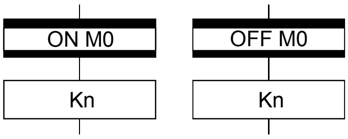
(b) Motion control step + WAIT



[Operations]

- Waits for the operating completion of the servo program Kn started at the motion control step, and then transits to the next step by formation of transition condition Gn.
- The operation completion condition of the servo program Kn is not needed in the transition condition Gn.
- An error stop of the started servo program Kn at/during a start is also regarded as an operation completion.

(c) WAITON/WAITOFF + Motion control step



[Operations]

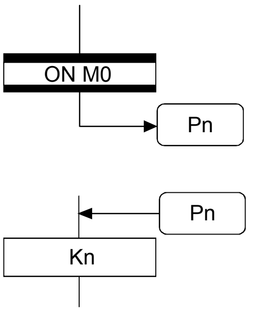
- Prepares for the start of the motion control step next to WAITON/WAITOFF, and makes a start immediately when the specified bit device turns ON/OFF. When the motion control step is executed without being used with WAITON/WAITOFF, preparations for a start are made after the transition condition preceding the motion control step enables. This will cause a variation of delay/starting time between when the transition condition is completed and when a start is made, but a combination with WAITON/WAITOFF can eliminate the variation of the above delay/starting time.

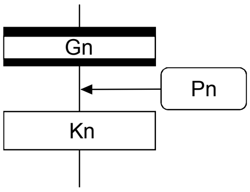
- Specifiable bit devices

Device	Range
X	X0 to X1FFF
Y	Y0 to Y1FFF
M	M0 to M8191
Special M	M9000 to M9255
L	L0 to L8191
B	B0 to B1FFF
F	F0 to F2047

[Instructions]

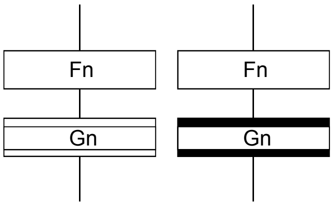
- Always pair a transition with a motion control step one-for-one. If the step following WAITON/WAITOFF is not a motion control step, the Motion SFC program error [16102] will occur and the Motion SFC program running will stop at the error detection.
- An error will not occur if the jump destination immediately after WAITON/WAITOFF is a motion control step. (Left below)
- A pointer may exist immediately after WAITON/WAITOFF. (Right below)





- If the servo program specified with a motion control step could not be started due to a major/minor error, the Motion SFC program continues running and execution shifts to the next, independently of the WAITON/WAITOFF bit device status. To stop the Motion SFC program at error detection, provide an error detection condition at the next transition (transition condition).
- The following instructions can be used in the motion control step used combining the WAITON/WAITOFF.
  (Linear interpolation control, circular interpolation control, helical interpolation, speed switching control, position follow-up control, constant-speed control and high speed oscillation.)

(2) Combination with operation control step



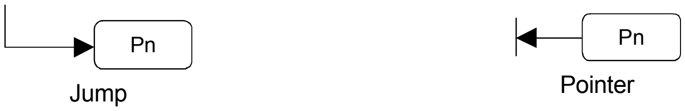
[Operations]

- At an operation control step, both Shift and WAIT perform the same operation, and after executing of the operation control program Fn, transits to the next step by formation of transition condition Gn.

(3) Combination with subroutine call/start step

Refer to Section "6.5.3 Subroutine call/start step".

6.7 Jump, Pointer

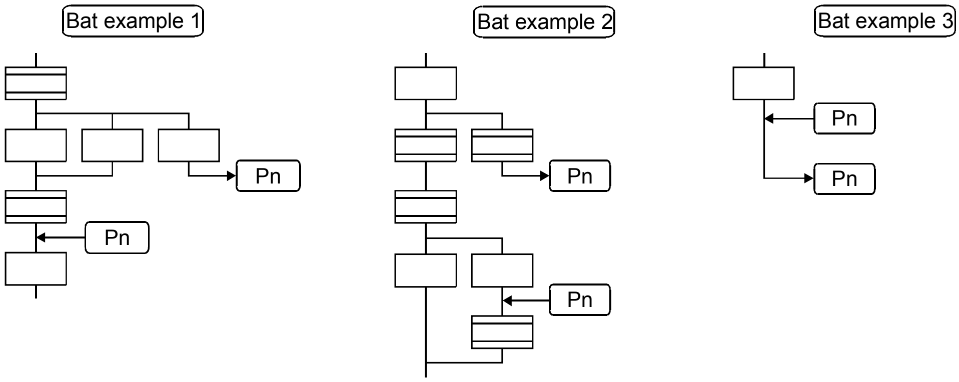


[Operations]

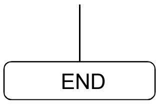
- Setting a jump will cause a jump to the specified pointer Pn of the self program.
- You can set pointers at steps, transitions, branch points and coupling points.
- You can set pointers Pn at P0 to P16383 in one program.

[Instructions]

- You cannot make a jump setting which will exit from within parallel branch-parallel coupling. Connect directly. (Bad example 1 given below)
- You cannot make a jump setting from outside parallel branch-parallel coupling to within parallel branch-parallel coupling. (Bad example 2 given below)
- You cannot make a setting where a label and a jump will continue. (Bad example 3 given below)



6.8 END



[Operations]

- Ends a program. (In this case of an event task or NMI task, operation changes with end operation setting of the program parameter. Refer to Section "11.5 Program Parameters" for details.)
- Making a subroutine call will return to the call source Motion SFC program.

[Instructions]

- END may be set a multiple number of times in one program.
- END cannot be set between a parallel branch and a parallel coupling.
- The output is held after the Motion SFC program is ended by END.

6.9 Branches, Couplings

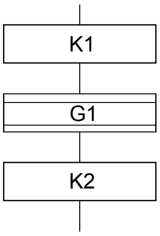
6.9.1 Series transition

Transits execution to the subsequent step or transition connected in series.

(1) To start a servo program or subroutine and shift execution to the next without waiting for operation completion

Set Shift at a transition.

In this case, the transition (shift) may be omitted. When you omitted the transition, an unconditional shift transition is performed.



Starts the servo program K1.

Transits to next by the completion of condition set at transition G1 without waiting for operating completion of the servo program K1.

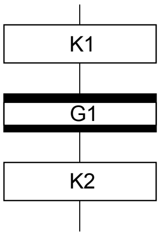
Starts the servo program K2.

POINT

For a subroutine start, self program and a subroutine program are processed in parallel.

(2) To start a servo program or subroutine and proceed to the next step on operation completion

Set WAIT at a transition.



Starts the servo program

Transits to next when the start axis stops in the servo program K1 (start accept flag turns OFF) and condition is completed set at transition G1.

Starts servo program K2.

POINT

(1) The above start accept flag of the axis started in the next servo program K2 is not included in interlocks.
To use it as an interlock, the user should set it in the transition condition G1.

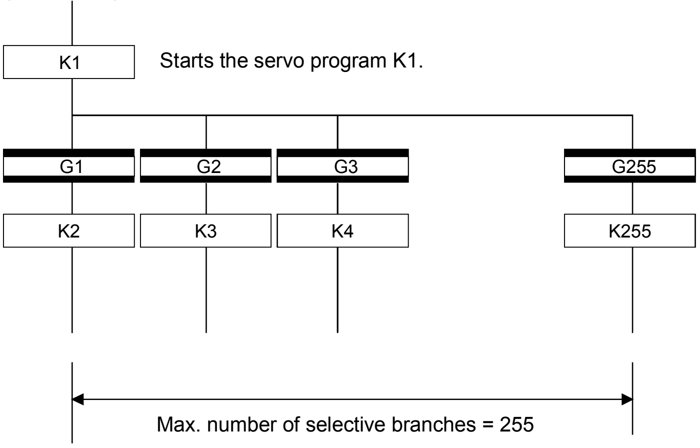
(2) WAIT must be set to proceed to the next step on operation completion.
However, when there are specifically no conditions to be set as interlocks, set "NOP (No Operation)" in the transition program (Gn).

6.9.2 Selective branch, selective coupling

(1) Selective branch

Executes only the route which condition was judged to have enabled first among the conditions of multiple transitions connected in parallel. Transitions must be all Shifts or WAITs.

(Example) WAIT


K1
Starts the servo program K1.
G1
G2
G3
G255
K2
K3
K4
K255
Max. number of selective branches = 255

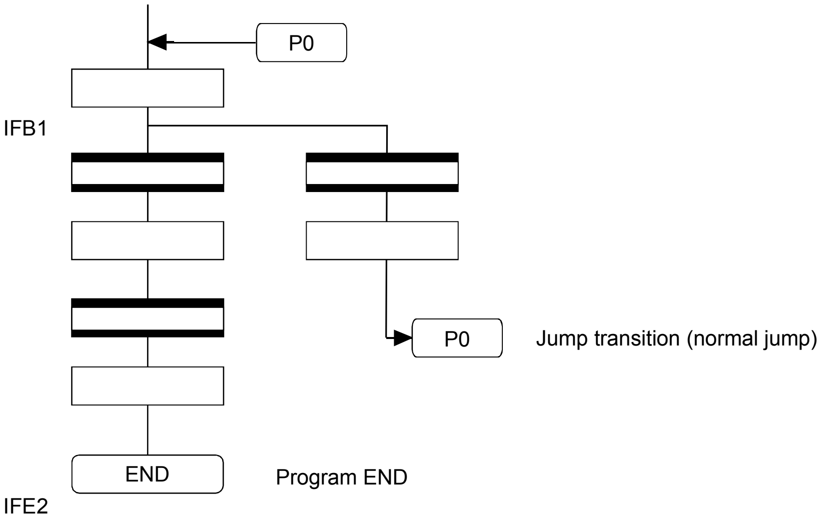
After start axis in the servo program K1 has stopped (start accept flag turns OFF), the conditions of transitions G1 to G255 are judged, and execution transits to route which condition is completed.

POINT

(1) Transition condition judgment is not always executed from left to right.
(2) Using Shift and WAIT together will cause a parallel branch.

(2) Selective coupling

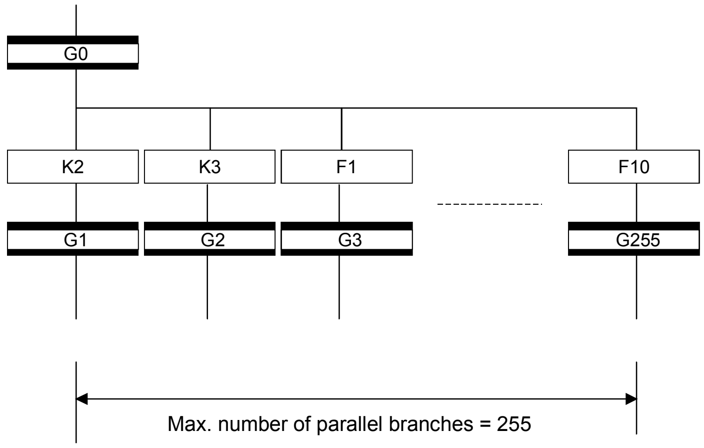
Recoupling of routes into a single route after their processing completions following a selective branch will be a selective coupling. However, you can also make a setting where no coupling will be made as shown below.



6.9.3 Parallel branch, parallel coupling

(1) Parallel branch

Multiple routes connected in parallel are executed simultaneously. Each parallel branch destination may be started by either a step or a transition.



After operation completion of preceding step, steps K2 to F10 connected in parallel are executed when the completion of condition set at transition G0. Thereafter, routes are executed simultaneously up to parallel coupling point.

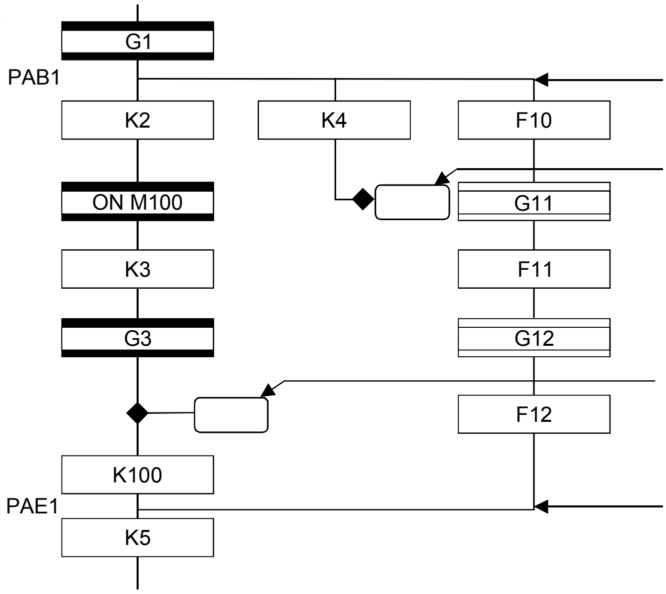
POINT

"Shift" or "WAIT" can be set to a transition preceding a parallel branch.
"WAITON" and "WAITOFF" cannot be set.

(2) Parallel coupling

A parallel branch must be coupled by a parallel coupling. A jump setting to another branch route can be made within parallel branch-parallel coupling. In this case, a jump destination is a midway parallel coupling point (coupling jump).

You cannot set a jump to exit from within parallel branch-parallel coupling.



Parallel branch point

Coupling jump

After the servo program K3 has completed stopping, execution waits until the completion of condition set at transition G3 and servo program K4 completes starting.
On completion of waiting, execution transits to the next (lower part).

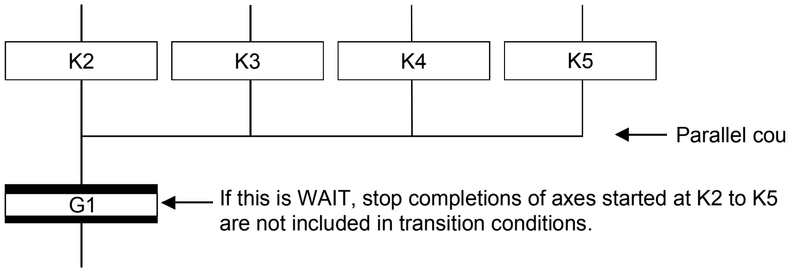
Parallel coupling point

POINT

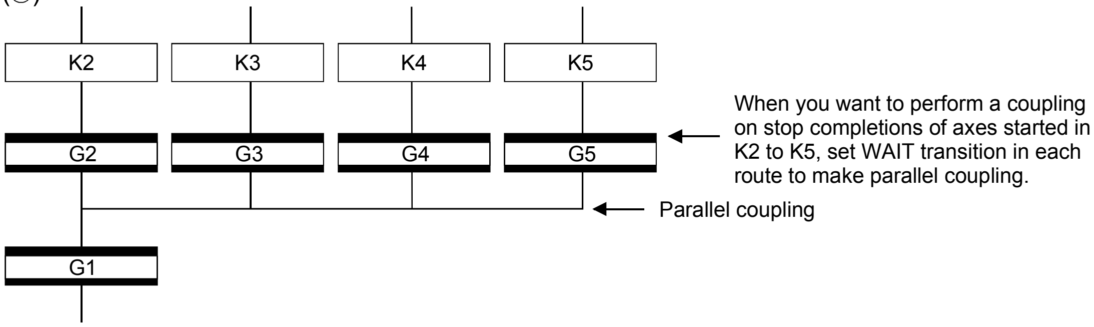
The number of parallel branches need not match that of couplings at a parallel coupling point.
(In the example of the diagram in Section 6.9.3 (2), the number of parallel branches is 3 and that of couplings is 2.)

When a WAIT transition is set right after a parallel coupling, the stop completions of the axes are not included in the waiting conditions if the parallel coupling is preceded by motion control steps. To perform a parallel coupling on stop completions, set WAIT transitions before a parallel coupling.

(×)

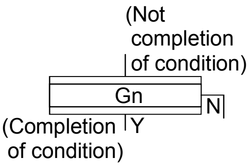
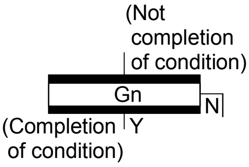

K2
K3
K4
K5
Parallel coupling
G1
If this is WAIT, stop completions of axes started at K2 to K5 are not included in transition conditions.

(○)


K2
K3
K4
K5
G2
G3
G4
G5
When you want to perform a coupling on stop completions of axes started in K2 to K5, set WAIT transition in each route to make parallel coupling.
Parallel coupling
G1

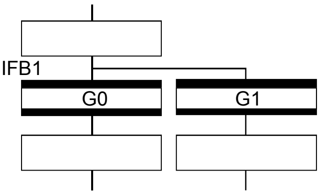
6.10 Y/N Transitions

When routes are branch at a transition condition enables and disable, "Shift Y/N transition" or "WAIT Y/N transition" will be useful.

Name	Symbol	Function
Shift Y/N transition	 (Not completion of condition) Gn N (Completion of condition) Y	• When a transition condition set at Gn enables, execution shifts to the lower step. When that condition disables, execution shifts to the right-connected step. • Differences between "Shift Y/N" and "WAIT Y/N" are the same as those between "Shift" and "WAIT".
WAIT Y/N transition	 (Not completion of condition) Gn N (Completion of condition) Y	

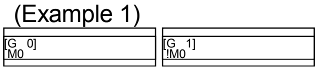
A Y/N transition is designed to describe the following two-route selective branch program easily.

<Y/N transition is not used.>

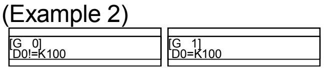


- G0 and G1 programs should be different only in acknowledgement/negation of the conditional expressions.

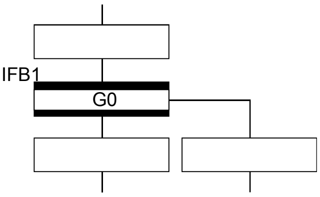
(Example 1)



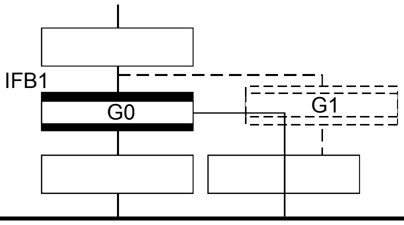
(Example 2)



<Y/N transition is used.>



- Set the G0 program shown in above (Example 1) or (Example 2) as a G0 program.
- The Motion SFC program list codes after conversion are the same as in the conventional description (different only in the Motion SFC chart representation). Therefore, "automatic search for free G number → automatic generation of program which conditional expression part is logically negated" is performed during program editing to occupy two G programs. Using "Program editor" to delete a Y/N transition does not delete the automatically generated G program (G1 below). Use "Program use list" to delete that program.



(1) Automatic free G number search feature

(a) When not set to automatic numbering

Searches for a free number forward, starting with the "set G number + 1" at the "Shift Y/N" or "WAIT Y/N" symbol.

When no free numbers are found after a search up to 4095, a search is made from 0 to the "set G number - 1".

(b) When set to automatic numbering

Searches for a free number forward (or backward) in the automatic numbering range, starting with the "automatically numbered G number + 1 (or -1)" at the "Shift Y/N" or "WAIT Y/N" symbol. (The searching method is as in the automatic numbering setting.)

(2) Automatic logical NOT program generation feature

Automatically generates a program which logically negates the conditional expression block (last block) of the transition program set at "Shift Y/N" or "WAIT Y/N".

The basic is shown below.

<Setting program (conditional expression block)>

```
Conditional expression//(bit conditional expression or comparison conditional expression)
```

⬇

<Logically negated, automatically generated program (conditional expression block)>

```
!Conditional expression//(bit conditional expression or comparison conditional expression)
```

Examples are shown below.

<Setting program (conditional expression block)>

(Example 1)

```
M0          //Bit device ON
```

(Example 2)

```
D0!=K100    //Data register D0 is not K100
```

<Logically negated, automatically generated program (conditional expression block)>

(Example 1)

```
!(M0)       //Bit device OFF
```

(Example 2)

```
!(D0!=K100) //Data register D0 is K100
```

POINT

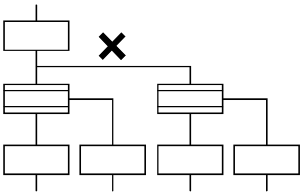
Refer to Section "1.2.3 (2) Table of the operation control/transition instruction" for the instructions usable in the conditional expressions of "Shift Y/N" or "WAIT Y/N" transition programs.

(3) Instructions for the Motion SFC charts

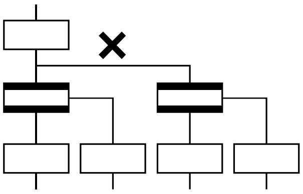
Any Motion SFC chart that will be meaningless to or conflict with the definition of Y/N transitions will result in an error at the time of editing (or Motion SFC chart conversion). Their patterns and instructions will be given below.

(a) When "Shift Y/N" or "WAIT Y/N" is connected as a selective branch or parallel branch: Error

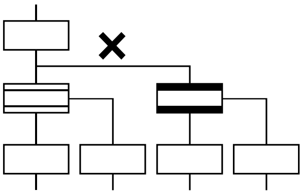
- "Shift Y/N" used as selective branch



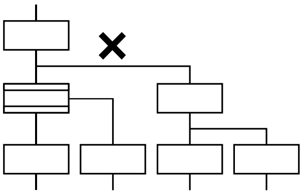
- "WAIT Y/N" used as selective branch



- "Shift Y/N" and "WAIT Y/N" used as parallel branch

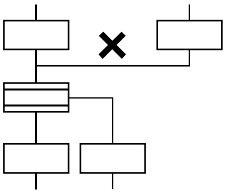


- "Shift (or WAIT) Y/N" used with other step/transition as parallel branch or selective branch

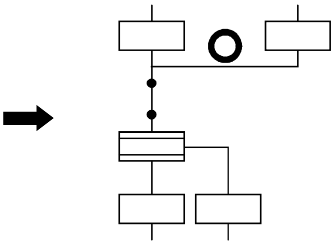


(b) When a coupling precedes "Shift Y/N" or "WAIT Y/N: Provide "coupling-branch continuation" in between.

- Direct coupling with "Shift Y/N" or "WAIT Y/N" is not allowed.

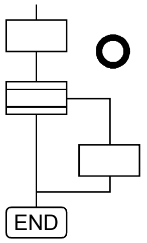


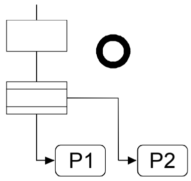
- Provide "coupling-branch continuation" in between.



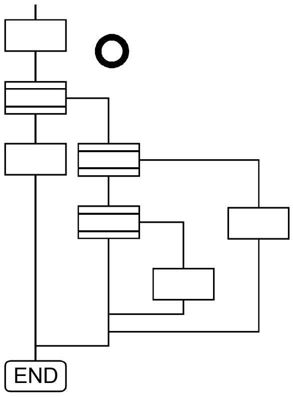
(c) The following patterns may be set.

- End (END) from "Shift Y/N" or "WAIT Y/N"
- Jump from "Shift Y/N" or "WAIT Y/N"

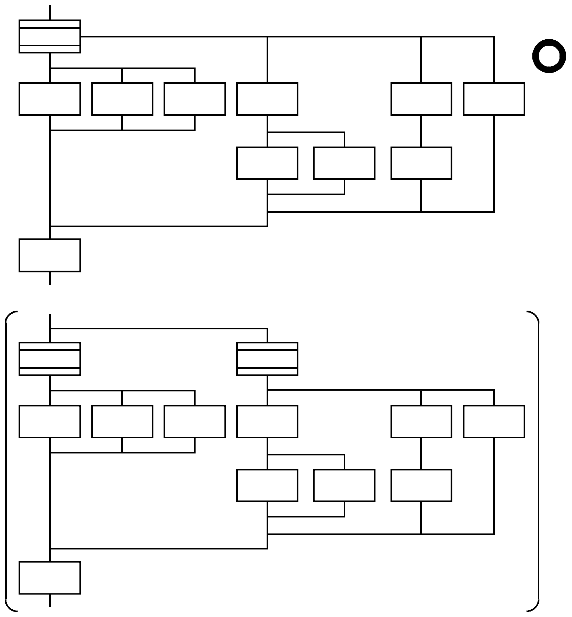




- Continuation from "Shift Y/N" or "WAIT Y/N" to "Shift Y/N" or "WAIT Y/N" (selective branch-selective branch)

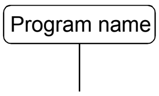
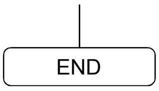
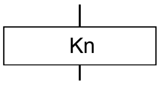
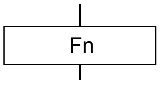
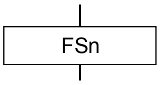
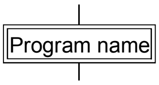
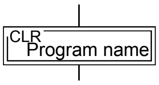
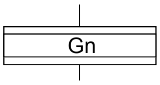
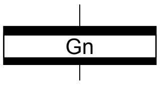
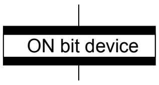
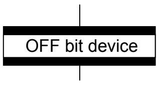
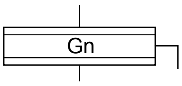
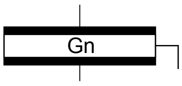
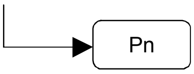
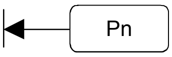


- When there are two or more connection lines from Y/N side of "Shift Y/N" or "WAIT Y/N", selective branch continues to selective branch or parallel branch.



6.11 Motion SFC Comments

A comment can be set to each symbol of the step/transition in the motion SFC chart. Comments are shown in the Motion SFC chart by changing the display mode to "Comment display" on the Motion SFC program edit screen.
Since the Motion SFC comments are stored into the CPU code area, performing read from PC displays the Motion SFC chart with comments.

Classification	Name	Symbol	Comment Setting
Program start/end	START		Comment setting cannot be made.
	END		
Step	Motion control step		Up to 80 characters Displayed in 20 characters × 4 lines
	Once execution type operation control step		
	Scan execution type operation control step		
	Subroutine call/start step		
	Clear step		
Transition	Shift (preread transition)		
	WAIT		
	WAITON		
	WAITOFF		
	Shift Y/N		
	WAIT Y/N		
Jump	Jump		Up to 64 characters Displayed in 16 characters × 4 lines
Pointer	Pointer		

POINT

(1) Motion SFC comments are stored into the CPU code area. The CPU code area stores the Motion SFC chart codes, operation control (F/FS) program codes, transition (G) program codes and Motion SFC comments.
Be careful not to set too many comments to avoid code area overflow. (Refer to Section "1.2.2 (2) (b) Motion SFC Performance Specifications" for the code area sizes.)

(2) You cannot use "," in comment statements.

MEMO

7. OPERATION CONTROL PROGRAMS

Refer to Section "19.2 Motion SFC Error Code List" for error codes of the operation error.
(Refer to the "Q173CPU(N)/Q172CPU(N) Motion controller (SV13/SV22) Programming Manual (REAL MODE)" and "Q173CPU(N)/Q172CPU(N) Motion controller (SV22) Programming Manual (VIRTUAL MODE)" for minor errors of the operation error.)

7.1 Operation Control Programs

(1) Operation control programs

(a) Substitution operation expressions, motion-dedicated functions and bit device control commands can be set in operation control program.

(b) Multiple blocks in one operation control program can be set.

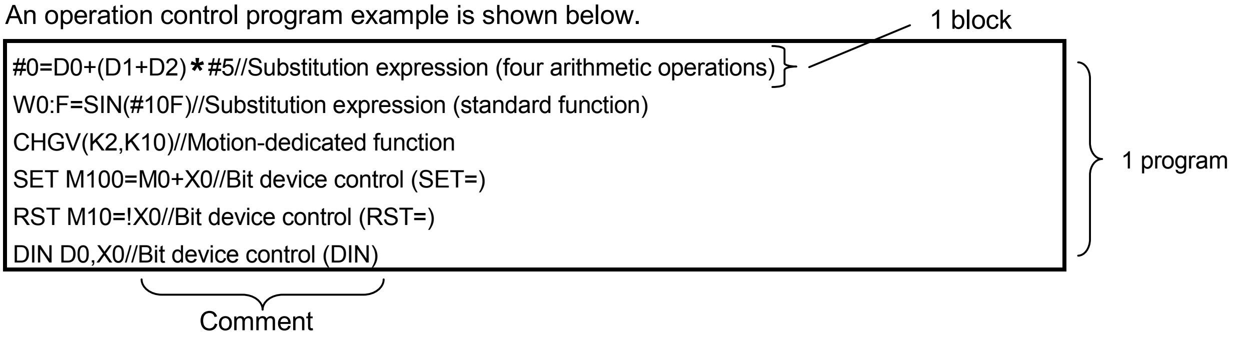
(c) There are no restrictions on the number of blocks that may be set in one operation control program. However, one program is within 64k bytes.

(d) The maximum number of characters in one block is 128.

(e) Transition conditions cannot be set. Transition conditions can be set only in transition programs.

(f) The bit conditional expression that logical data value (true or false) is returned in an operation control program, a comparison conditional expression can be set up only as a source (S) of device set (SET=) or device reset (RST=).

An operation control program example is shown below.



```
#0=D0+(D1+D2)*#5//Substitution expression (four arithmetic operations)
W0:F=SIN(#10F)//Substitution expression (standard function)
CHGV(K2,K10)//Motion-dedicated function
SET M100=M0+X0//Bit device control (SET=)
RST M10=!X0//Bit device control (RST=)
DIN D0,X0//Bit device control (DIN)
```

(2) Priorities of operators and functions

Operators and functions have the following priorities.

Using parentheses allows an operation sequence to be specified freely.

Priority	Item (Operator, Function)
High	Calculation within parentheses ((...))
	Standard function (SIN, COS, etc.), Type conversion (USHORT, LONG, etc.)
	Bit inversion (~), logical negation (!), sign inversion (－)
	Multiplication (*), division (/), remainder (%)
	Addition (+), subtraction (－)
	Bit left shift (<<), bit right shift (>>)
	Comparison operators: Less than (<), less than or equal to (<=), more than (>), more than or equal to (>=)
	Comparison operators: Equal to (==), not equal to (!=)
	Bit logical AND (&)
	Bit exclusive OR (^)
	Bit logical OR (|)
	Logical AND (*)
	Logical OR (+)
Low	Substitution (=)

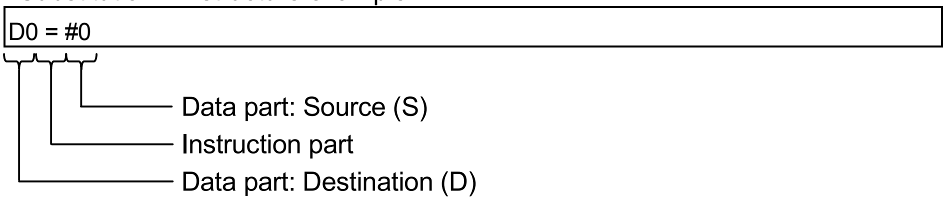
(3) Structure of instruction

Many of the instructions usable in operation control programs can be divided into instruction and data parts.

The instruction and data parts are used for the following purposes.

- Instruction part.......... Indicates the function of that instruction.
- Data part................... Indicates the data used in the instruction.

"Substitution: =" structure example



```
D0 = #0
```

(a) Source (S)

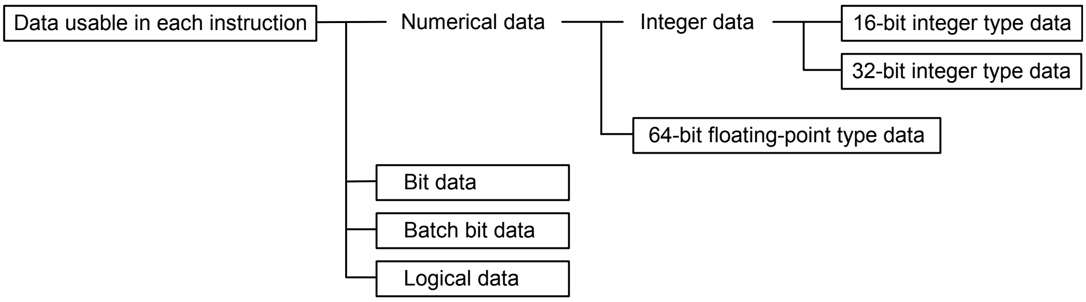
1) The source is the data used in an operation.
2) It varies with the device specified in each instruction is shown below.
   - Bit or word device
     Specify the device which stores the data used in operation.
     The data must have been stored in the specified device until the operation is executed.
     Changing the data stored in the specified device during program execution allows changing the data used in that instruction.
   - Constant
     Specify the numerical value used in an operation.
     As the constant is set during program creation, it cannot be changed during program running.

(b) Destination (D)

1) As the destination data, after-operation data is stored.
2) Destination data is always set the device for storing the data.

(4) How to specify data

There are the following six different data usable in each instruction.



(a) 16-bit integer type data

The 16-bit integer type data is 16-bit integer value data.

Word devices are used in increments of 1 point.

Data ranges are shown below.

	Decimal representation	Hexadecimal representation
Data range	K-32768 to K32767	H0000 to HFFFF

(b) 32-bit integer type data

The 32-bit integer type data is 32-bit integer value data.

Word devices are used in increments of 2 points: (specified device No.), (specified device No.+1). Data ranges are shown below.

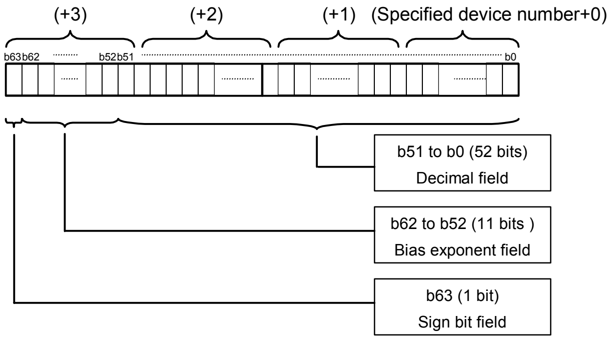
	Decimal representation	Hexadecimal representation
Data range	K-2147483648L to K2147483647L	H00000000L to HFFFFFFFFL

(c) 64-bit floating-point type data

The 64-bit floating-point type data is IEEE-formatted, 64-bit floating-point value data.

Word devices are used in increments of 4 points: (specified device No.), (specified device No.+1), (specified device No.+2), (specified device No.+3).

1) The internal bit locations are shown below.



2) The represented value is shown below. (The bias value is H3FF.)

$$(-1)^{[\text{Sign bit field}]} * (1.0+[\text{decimal field}]) * 2^{([\text{Bias exponent field}]-[\text{bias value}])}$$

3) Data ranges are shown below.

	Decimal representation	Hexadecimal representation
Data range	K-1.79E+308 to K-2.23E-308, K0.0, K2.23E-308 to K1.79E+308	H0000000000000000, H0010000000000000 to H7FE1CCF385EBC89F, H8000000000000000, H8010000000000000 to HFFE1CCF385EBC89F

4) A round-off error may be produced in a 64-bit floating-point type data operation. Especially when using 64-bit floating-point type data in a comparison operation, note that a round-off error may cause an intended operation.

Example) In the following transition program, the result of the comparison operation may not become true depending on the value of #200F due to a round-off error.

```
#100F=SQRT(#200F)
#300F=#100F*#100F
#200F==#300F
```

(d) Bit data

The bit data is the data where a contact/coil or similar device is handled in increments of 1 bit. It is used in device set (SET=) and device reset (RST=).

Example 1

```
SET M0
```

Bit data

(e) Batch bit data

The batch bit data is the data where bit data is handled in increments of 16/32 points. It is used in device input (DIN) and device output (DOUT).

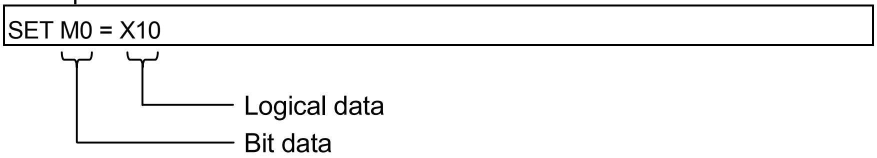
As indicated below, whether the bit data is handled in increments of 16 or 32 points is governed by the data type of the word device used as an input destination/output source.

	Increments of 16 points	Increments of 32 points
Program example	DIN #0, M0 DOUT M0, D0	DIN #0L, M0 DOUT M0, DOL
Used devices	(Specified device No.) to (specified device No.+15) M0 to M15 in the above program example	(Specified device No.) to (specified device No.+31) M0 to M31 in the above program example

(f) Logical data

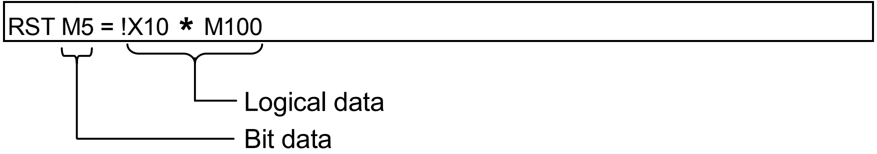
The logical data is a value returned by a bit or comparison conditional expression and indicates whether the result is true or false.
Normally, it is used in the conditional expression of a transition program. In an operation control program, the logical data is used in a bit conditional expression set to device set (SET=) or device reset (RST=).

Example 1



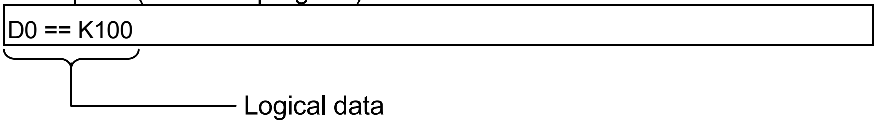
```
SET M0 = X10
```

Example 2



```
RST M5 = !X10 * M100
```

Example 3 (transition program)



```
D0 == K100
```

7.2 Device Descriptions

Word and bit device descriptions are shown below.

(1) Word device descriptions

	Device descriptions			Device No. (n) specifying ranges
	16-bit integer type	32-bit integer type ("n" is even No.)	64-bit floating-point type ("n" is even No.)	
Data register	Dn	DnL	DnF	0 to 8191
Link register	Wn	WnL	Wn:F	0 to 1FFF
Special register	Dn	DnL	DnF	9000 to 9255
Motion device	#n	#nL	#nF	0 to 8191 (Motion SFC dedicated devices : 8000 to 8191)
Coasting timer	—	FT	—	—

(a) For differentiation, the 32-bit floating-point type is ended by L and the 64-bit floating-point type by F (F for the link register).

(b) For the 32-bit integer type and 64-bit floating-point type, specify the device number with an even number. (It cannot be set as an odd number).

(c) The coasting timer FT is incremented per 888μs. (The coasting timer is a 32-bit integer type.)

(2) Bit device descriptions

	Device description	Device No. (n) specifyied ranges
Input relay	Xn/PXn	0 to 1FFF
Output relay	Yn/PYn	0 to 1FFF
Internal relay	Mn	0 to 8191
Latch relay	Ln	0 to 8191
Link relay	Bn	0 to 1FFF
Annunciator	Fn	0 to 2047
Special relay	Mn	9000 to 9255

(a) When using the device in DIN or DOUT as batch bit data, specify n as a multiple of 16.

(3) Indirect specification of device No.

In the above word/bit device descriptions, device No. (n) can be specified indirectly.

(a) Indirect specification of device No. (n) using word device

- The word device which the device No. was specified indirectly cannot be used.
- You can use the 16-bit and 32-bit integer type word devices for indirect specification.
  The 64-bit floating-point type cannot be used.

(Description examples)

Good example	Bad example
#(D10)	#(D(D5))
D(#10L)F	D(#4F)

(b) Indirect specification of device No. (n) using word device using operation expression

- Device No. can be specified indirectly by calculation expressions which use the following data and operators.

Usable data	16-bit integer type word device
	32-bit integer type word device
	16-bit integer type constant
	32-bit integer type constant
Usable operators	Addition: +
	Subtraction: －
	Multiplication: ＊
	Division: /
	Remainder: %
	Sign inversion: －

- The word device which the device No. is specified indirectly cannot be used.
- Only one operator may be used.

(Description examples)

Good example	Bad example
#(D10-K5)	#(D(D5)F+K20)
D(#10L%H6L)F	D(#4L<<K2)

(Note) : When you want to use the result of calculation other than the above to specify the device No. indirectly, describe it in two blocks as shown below.

```
D0=SHORT(ASIN(#0F))
W0=#(D0)
```

7.3 Constant Descriptions

The constant descriptions of the 16-bit integer type, 32-bit integer type and 64-bit floating-point type are shown below.

	16-Bit integer type	32-Bit integer type	64-Bit floating-point type
Decimal representation	K-32768 to K32767	K-2147483648L to K2147483647L	K-1.79E+308 to K-2.23E-308, K0.0, K2.23E-308 to K1.79E+308
Hexadecimal representation	H0000 to HFFFF	H00000000L to HFFFFFFFFL	—

(1) The 32-bit integer type is ended by L and the 64-bit floating-point type is provided with a decimal point and exponent part (E) to denote their data types explicitly.

(2) The constant without the data type is regarded as the applicable minimum type.

(3) The constant in decimal representation is headed by K and the one in hexadecimal representation by H.
K can be omitted.

(4) The 64-bit floating-point type cannot be represented in hexadecimal.

F/FS	G
○	○

7.4 Binary Operations

7.4.1 Substitution : =

Format	(D)=(S)

Number of basic steps	4

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S)	—	○	○	○	○	○	○	○	○	—	—
(D)	—	○	○	○	—	—	—	—	—	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S)	Word device/constant/calculation expression to be substituted	Data type of (D)
(D)	Word device which will store the operation result	

[Functions]

(1) The data value specified with (S) is substituted to the specified word device at (D).

(2) When (S) and (D) differ in data type, the data at (S) is converted into the data type of (D) and the resultant data is substituted.
(When (D) is a 16- or 32-bit integer type and (S) is a 64-bit floating-point type, the fraction part of (S) is discarded.)

[Errors]

(1) An operation error will occur if:
- The data at (S) is outside the data type range of (D); or
- (D) or (S) is an indirectly specified device and its device No. is outside the range.

[Program examples]

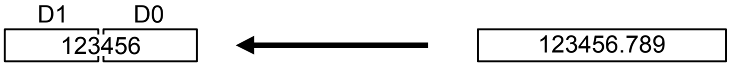
(1) Program which substitutes the D0 value to #0

```
#0 = D0
```

```
#0 [ 123 ]  ←——  D0 [ 123 ]
```

(2) Program which substitutes K123456.789 to D0L

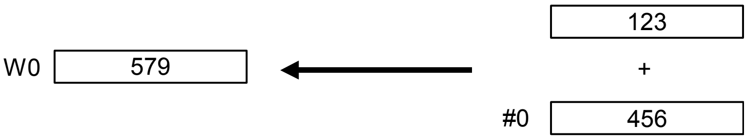
```
D0L = K123456.789
```



The 64-bit floating-point type is converted into the 32-bit integer type and the result is substituted.

(3) Program which substitutes the result of adding K123 and #0 to W0

```
W0 = K123 + #0
```



F/FS	G
○	○

7.4.2 Addition : +

Format	(S1)+(S2)

Number of basic steps	4

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S1)	—	○	○	○	○	○	○	○	○	—	—
(S2)	—	○	○	○	○	○	○	○	○	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S1)	Augend data	Data type of (S1) or (S2) which is greater
(S2)	Addend data	

[Functions]

(1) The data specified with (S2) is added to the data specified with (S1).

(2) When (S1) and (S2) differ in data type, the data of the smaller data type is converted into that of the greater type before operation is performed.

[Errors]

(1) An operation error will occur if:
- (S1) or (S2) is an indirectly specified device and its device No. is outside the range.

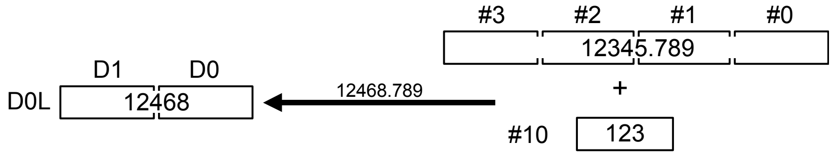
[Program examples]

(1) Program which substitutes the result of adding K123 and #0 to W0

```
W0 = K123 + #0
```

(2) Program which substitutes the result of adding #0F and #10 to D0L

```
D0L = #0F + #10
```



The 64-bit floating-point type data are used for addition, and the result is converted into the 32-bit integer type and then substituted.

F/FS	G
○	○

7.4.3 Subtraction : −

Format	(S1)−(S2)

Number of basic steps	4

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S1)	—	○	○	○	○	○	○	○	○	—	—
(S2)	—	○	○	○	○	○	○	○	○	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S1)	Minuend data	Data type of (S1) or (S2) which is greater
(S2)	Subtracted data	

[Functions]

(1) The data specified with (S2) is subtracted from the data specified with (S1).

(2) When (S1) and (S2) differ in data type, the data of the smaller data type is converted into that of the greater type before operation is performed.

[Errors]

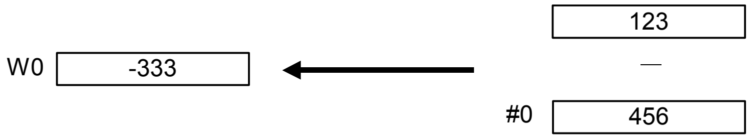
(1) An operation error will occur if:

- (S1) or (S2) is an indirectly specified device and its device No. is outside the range.

[Program examples]

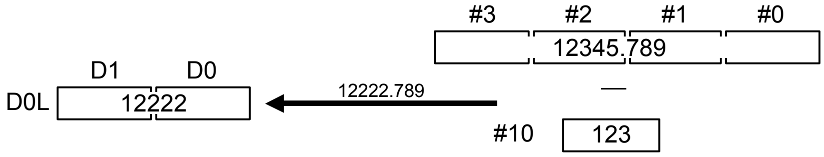
(1) Program which substitutes the result of subtracting #0 from K123 to W0

```
W0 = K123−#0
```



(2) Program which substitutes the result of subtracting #10 from #0F to D0L

```
D0L = #0F－#10
```



64-bit floating-point type data are used for subtraction, and the result is converted into the 32-bit integer type and then substituted. The

F/FS	G
○	○

7.4.4 Multiplication : *

Format	(S1)*(S2)

Number of basic steps	4

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S1)	—	○	○	○	○	○	○	○	○	—	—
(S2)	—	○	○	○	○	○	○	○	○	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S1)	Multiplicand data	Data type of (S1) or (S2) which is greater
(S2)	Multiplier data	

[Functions]

(1) The data specified with (S1) is multiplied by the data specified with (S2).

(2) When (S1) and (S2) differ in data type, the data of the smaller data type is converted into that of the greater type before operation is performed.

[Errors]

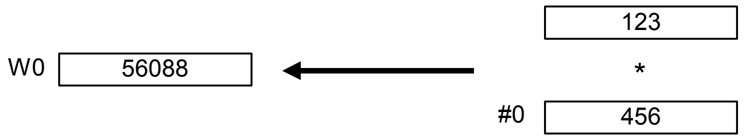
(1) An operation error will occur if:

- (S1) or (S2) is an indirectly specified device and its device No. is outside the range.

[Program examples]

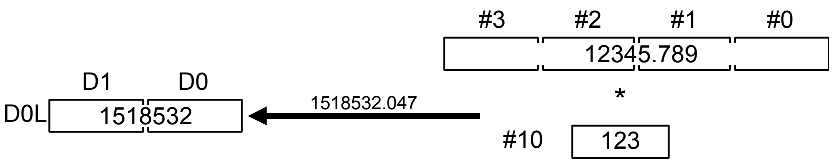
(1) Program which substitutes the result of multiplying K123 by #0 to W0

```
W0 = K123*#0
```



(2) Program which substitutes the result of multiplying #0F by #10 to D0L

```
D0L = #0F*#10
```



The 64-bit floating-point type data are used for multiplication, and the result is converted into the 32-bit integer type and then substituted.

F/FS	G
○	○

7.4.5 Division : /

Format	(S1)/(S2)

Number of basic steps	4

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S1)	—	○	○	○	○	○	○	○	○	—	—
(S2)	—	○	○	○	○	○	○	○	○	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S1)	Dividend data	Data type of (S1) or (S2) which is greater
(S2)	Divisor data	

[Functions]

(1) The data specified with (S1) is divided by the data specified with (S2) to find a quotient.

(2) When (S1) and (S2) differ in data type, the data of the smaller data type is converted into that of the greater type before operation is performed.

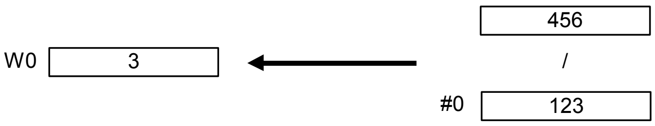
[Errors]

(1) An operation error will occur if:
- (S2) is 0; or
- (S1) or (S2) is an indirectly specified device and its device No. is outside the range.

[Program examples]

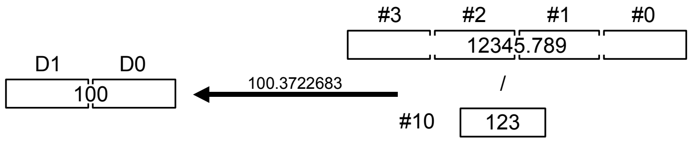
(1) Program which divides K456 by #0 and substitutes a quotient to W0

```
W0 = K456 / #0
```



(2) Program which divides #0F by #10 and substitutes a quotient to D0L

```
D0L = #0F / #10
```



The 64-bit floating-point type data are used for division, and the quotient is converted into the 32-bit integer type and then substituted.

F/FS	G
○	○

7.4.6 Remainder : %

Format	(S1)%(S2)

Number of basic steps	4

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S1)	—	○	○	—	○	○	○	—	○	—	—
(S2)	—	○	○	—	○	○	○	—	○	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S1)	Dividend data	Data type (integer type) of (S1) or (S2) which is greater (Integer type)
(S2)	Divisor data	

[Functions]

(1) The data specified with (S1) is divided by the data specified with (S2) to find a remainder.

(2) When (S1) and (S2) differ in data type, the data of the smaller data type is converted into that of the greater type before operation is performed.

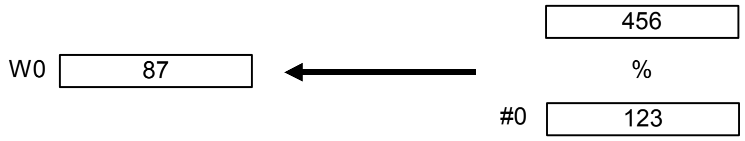
[Errors]

(1) An operation error will occur if:
- (S2) is 0; or
- (S1) or (S2) is an indirectly specified device and its device No. is outside the range.

[Program examples]

(1) Program which divides K456 by #0 and substitutes a remainder to W0

```
W0 = K456 % #0
```



F/FS	G
○	○

7.5 Bit Operations

7.5.1 Bit inversion (Complement) : ˜

Format	˜(S)

Number of basic steps	2

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S)	—	○	○	—	○	○	○	—	○	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S)	Data whose bits will be inverted	Data type of (S) (Integer type)

[Functions]

(1) The bit inverted value of the data specified with (S) is found.

[Errors]

(1) An operation error will occur if:
- (S) is an indirectly specified device and its device No. is outside the range.

[Program examples]

(1) Program which finds the bit inverted value of #0 and substitutes the value to D0

```
D0 = ˜#0
```

```
     b15 ........................... b0        b15 ........................... b0
D0  |1|1|0|1|1|0|1|0|1|1|0|0|1|0|1|1|  ◀────  #0  |0|0|1|0|0|1|0|1|0|0|1|1|0|1|0|0|
```

F/FS	G
○	○

7.5.2 Bit logical AND : &

Format	(S1)&(S2)

Number of basic steps	4

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S1)	—	○	○	—	○	○	○	—	○	—	—
(S2)	—	○	○	—	○	○	○	—	○	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S1)	Data which will be ANDed bit-by-bit	Data type of (S1) or (S2) which is greater (Integer type)
(S2)		

[Functions]

(1) The bit-by-bit logical product of the data specified with (S1) and the data specified with (S2) is found.

(2) When (S1) and (S2) differ in data type, the data of the smaller data type is converted into that of the greater type before operation is performed. At this time, note that signed data is converted.

[Errors]

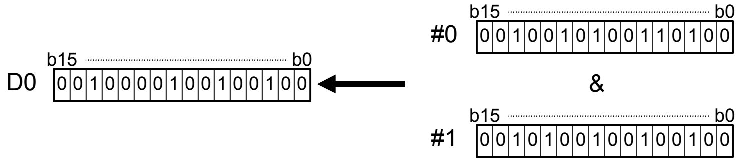
(1) An operation error will occur if:

- (S1) or (S2) is an indirectly specified device and its device No. is outside the range.

[Program examples]

(1) Program which ANDs #0 and #1 and substitutes the result to D0

```
D0 = #0 & #1
```



F/FS	G
○	○

7.5.3 Bit logical OR : |

Format	(S1) I (S2)

Number of basic steps	4

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S1)	—	○	○	—	○	○	○	—	○	—	—
(S2)	—	○	○	—	○	○	○	—	○	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S1)	Data which will be ORed bit-by-bit	Data type of (S1) or (S2) which is greater (Integer type)
(S2)		

[Functions]

(1) The bit-by-bit logical add of the data specified with (S1) and the data specified with (S2) is found.

(2) When (S1) and (S2) differ in data type, the data of the smaller data type is converted into that of the greater type before operation is performed. At this time, note that signed data is converted.

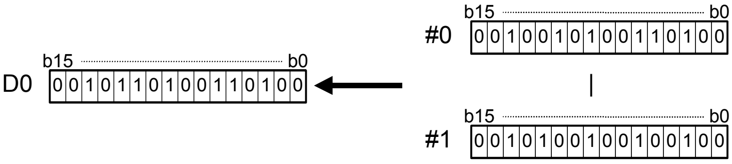
[Errors]

(1) An operation error will occur if:
- (S1) or (S2) is an indirectly specified device and its device No. is outside the range.

[Program examples]

(1) Program which ORs #0 and #1 and substitutes the result to D0

```
D0 = #0 I #1
```



F/FS	G
○	○

7.5.4 Bit exclusive logical OR : ^

Format	(S1)^(S2)

Number of basic steps	4

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S1)	—	○	○	—	○	○	○	—	○	—	—
(S2)	—	○	○	—	○	○	○	—	○	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S1)	Data which will be EXCLUSIVE ORed bit-by-bit	Data type of (S1) or (S2) which is greater (Integer type)
(S2)		

[Functions]

(1) The bit-by-bit exclusive logical add of the data specified with (S1) and the data specified with (S2) is found.

(2) When (S1) and (S2) differ in data type, the data of the smaller data type is converted into that of the greater type before operation is performed. At this time, note that signed data is converted.

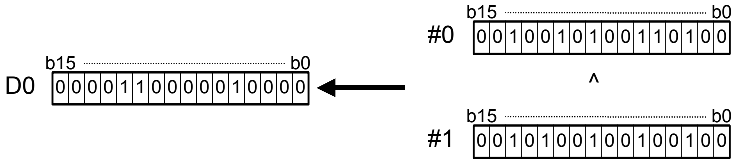
[Errors]

(1) An operation error will occur if:
- (S1) or (S2) is an indirectly specified device and its device No. is outside the range.

[Program examples]

(1) Program which EXCLUSIVE ORs #0 and #1 and substitutes the result to D0

```
D0 = #0 ^ #1
```



#0: 0 0 1 0 0 1 0 1 0 0 1 1 0 1 0 0

#1: 0 0 1 0 1 0 0 1 0 0 1 0 0 1 0 0

D0: 0 0 0 0 1 1 0 0 0 0 0 1 0 0 0 0

F/FS	G
○	○

7.5.5 Bit right shift : >>

Format	(S1) >> (S2)

Number of basic steps	4

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S1)	—	○	○	—	○	○	○	—	○	—	—
(S2)	—	○	○	—	○	○	○	—	○	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S1)	Data to be right-shifted	Data type of (S1) (Integer type)
(S2)	Number of right shifts	

[Functions]

(1) The data specified with (S1) is shifted to the right by the number of times specified with (S2).

(2) If the most significant bit of (S1) is 1, 1 enters the most significant bit of the right shift result.
If the most significant bit of (S1) is 0, 0 enters the most significant bit of the right shift result.

(3) When (S1) is a 16-bit integer type and (S2) is a negative number or not less than 16, the result is 0.

(4) When (S1) is a 32-bit integer type and (S2) is a negative number or not less than 32, the result is 0.

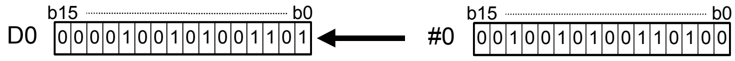
[Errors]

(1) An operation error will occur if:
- (S1) or (S2) is an indirectly specified device and its device No. is outside the range.

[Program examples]

(1) Program which shifts #0 two bit positions to the right and substitutes the result to D0

```
D0 = #0 >> K2
```



F/FS	G
○	○

7.5.6 Bit left shift : <<

Format	(S1) << (S2)

Number of basic steps	4

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S1)	—	○	○	—	○	○	○	—	○	—	—
(S2)	—	○	○	—	○	○	○	—	○	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S1)	Data to be left-shifted	Data type of (S1) (Integer type)
(S2)	Number of left shifts	

[Functions]

(1) The data specified with (S1) is shifted to the left by the number of times specified with (S2).

(2) 0 enters the least significant bit of the left shift result.

(3) When (S1) is a 16-bit integer type and (S2) is a negative number or not less than 16, the result is 0.

(4) When (S1) is a 32-bit integer type and (S2) is a negative number or not less than 32, the result is 0.

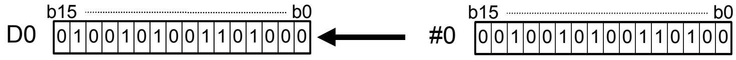
[Errors]

(1) An operation error will occur if:
- (S1) or (S2) is an indirectly specified device and its device No. is outside the range.

[Program examples]

(1) Program which shifts #0 one bit position to the left and substitutes the result to D0

```
D0 = #0 << K1
```



	b15															b0
D0	0	1	0	0	1	0	1	0	0	1	1	0	1	0	0	0
#0	0	0	1	0	0	1	0	1	0	0	1	1	0	1	0	0

F/FS	G
○	○

7.5.7 Sign inversion (Complement of 2) : －

Format	－(S)

Number of basic steps	2

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S)	—	○	○	○	○	○	○	○	○	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S)	Data whose sign will be inverted	Data type of (S)

[Functions]

(1) The sign-inverted value of the data specified with (S) is found.

[Errors]

(1) An operation error will occur if:

- (S) is an indirectly specified device and its device No. is outside the range.

[Program examples]

(1) Program which substitutes the sign-inverted value of #0 to D0

```
D0 =－#0
```

D0 | -123 | ← | #0 | 123

F/FS	G
○	○

7.6 Standard Functions

7.6.1 Sine : SIN

Format	SIN(S)

Number of basic steps	2

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S)	—	○	○	○	○	○	○	○	○	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S)	Angle data on which SIN (sine) operation will be performed	Floating-point type

[Functions]

(1) SIN (sine) operation is performed on the data specified with (S).

(2) The data specified with (S) is in an angle (degree) unit.

(3) If (S) is an integer type, it is converted into a floating-point type before operation is performed.

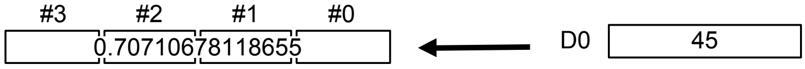
[Errors]

(1) An operation error will occur if:
- (S) is an indirectly specified device and its device No. is outside the range.

[Program examples]

(1) Program which performs the SIN operation of D0 and substitutes the result to #0F

```
#0F = SIN(D0)
```



F/FS	G
○	○

7.6.2 Cosine : COS

Format	COS(S)

Number of basic steps	2

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S)	—	○	○	○	○	○	○	○	○	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S)	Angle data on which COS (cosine) operation will be performed	Floating-point type

[Functions]

(1) COS (cosine) operation is performed on the data specified with (S).

(2) The data specified with (S) is in an angle (degree) unit.

(3) If (S) is an integer type, it is converted into a floating-point type before operation is performed.

[Errors]

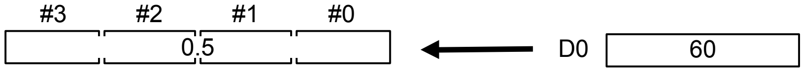
(1) An operation error will occur if:

- (S) is an indirectly specified device and its device No. is outside the range.

[Program examples]

(1) Program which performs the COS operation of D0 and substitutes the result to #0F

```
#0F = COS(D0)
```



F/FS	G
○	○

7.6.3 Tangent : TAN

Format	TAN(S)

Number of basic steps	2

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S)	—	○	○	○	○	○	○	○	○	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S)	Angle data on which TAN (tangent) operation will be performed	Floating-point type

[Functions]

(1) TAN (tangent) operation is performed on the data specified with (S).

(2) The data specified with (S) is in an angle (degree) unit.

(3) If (S) is an integer type, it is converted into a floating-point type before operation is performed.

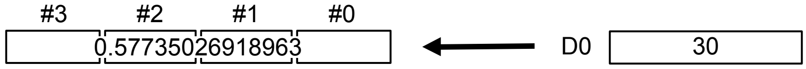
[Errors]

(1) An operation error will occur if:
- (S) is an indirectly specified device and its device No. is outside the range; or
- (S) is 90+(180*n). ("n" is an integer)

[Program examples]

(1) Program which performs the TAN operation of D0 and substitutes the result to #0F

```
#0F = TAN(D0)
```



F/FS	G
○	○

7.6.4 Arcsine : ASIN

Format	ASIN(S)

Number of basic steps	2

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S)	—	○	○	○	○	○	○	○	○	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S)	SIN value data on which SIN $^{-1}$ (arcsine) operation will be performed	Floating-point type

[Functions]

(1) SIN $^{-1}$ (arcsine) operation is performed on the SIN value data specified with (S) to find an angle.

(2) The SIN value specified with (S) must be within the range -1.0 to 1.0.

(3) The operation result is in an angle (degree) unit.

(4) If (S) is an integer type, it is converted into a floating-point type before operation is performed.

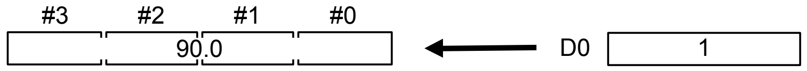
[Errors]

(1) An operation error will occur if:
- (S) is outside the range -1.0 to 1.0; or
- (S) is an indirectly specified device and its device number is outside the range.

[Program examples]

(1) Program which performs the SIN $^{-1}$ (arcsine) operation of D0 and substitutes the result to #0F

```
#0F = ASIN(D0)
```



F/FS	G
○	○

7.6.5 Arccosine : ACOS

Format	ACOS(S)

Number of basic steps	2

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S)	—	○	○	○	○	○	○	○	○	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S)	COS value data on which COS $^{-1}$ (arccosine) operation will be performed	Floating-point type

[Functions]

(1) COS $^{-1}$ (arccosine) operation is performed on the COS value data specified with (S) to find an angle.

(2) The COS value specified with (S) must be within the range -1.0 to 1.0.

(3) The operation result is in an angle (degree) unit.

(4) If (S) is an integer type, it is converted into a floating-point type before operation is performed.

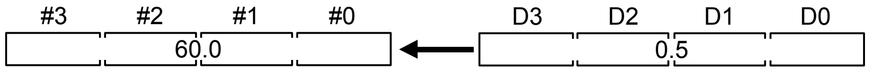
[Errors]

(1) An operation error will occur if:
- (S) is outside the range -1.0 to 1.0; or
- (S) is an indirectly specified device and its device No. is outside the range.

[Program examples]

(1) Program which performs the COS $^{-1}$ (arccosine) operation of D0F and substitutes the result to #0F

```
#0F = ACOS(D0F)
```



F/FS	G
○	○

7.6.6 Arctangent : ATAN

Format	ATAN(S)

Number of basic steps	2

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S)	—	○	○	○	○	○	○	○	○	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S)	TAN value data on which TAN $^{-1}$ (arctangent) operation will be performed	Floating-point type

[Functions]

(1) TAN $^{-1}$ (arctangent) operation is performed on the TAN value data specified with (S) to find an angle.

(2) The operation result is in an angle (degree) unit.

(3) If (S) is an integer type, it is converted into a floating-point type before operation is performed.

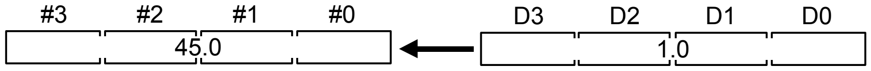
[Errors]

(1) An operation error will occur if:
- (S) is an indirectly specified device and its device No. is outside the range.

[Program examples]

(1) Program which performs the TAN $^{-1}$ (arctangent) operation of D0F and substitutes the result to #0F

```
#0F = ATAN(D0F)
```



F/FS	G
○	○

7.6.7 Square root : SQRT

Format	SQRT(S)

Number of basic steps	2

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S)	—	○	○	○	○	○	○	○	○	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S)	Data on which square root operation will be performed	Floating-point type

[Functions]

(1) The square root of the data specified with (S) is found.

(2) Only a positive number may be specified with (S). (Operation cannot be performed with a negative number.)

(3) If (S) is an integer type, it is converted into a floating-point type before operation is performed.

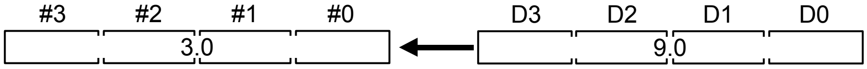
[Errors]

(1) An operation error will occur if:
- (S) is a negative number; or
- (S) is an indirectly specified device and its device No. is outside the range.

[Program examples]

(1) Program which finds the square root of D0F and substitutes the result to #0F

```
#0F = SQRT(D0F)
```



F/FS	G
○	○

7.6.8 Natural logarithm : LN

Format	LN(S)

Number of basic steps	2

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S)	—	○	○	○	○	○	○	○	○	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S)	Data on which natural logarithm operation will be performed	Floating-point type

[Functions]

(1) The base e natural logarithm of the data specified with (S) is found.

(2) Only a positive number may be specified with (S). (Operation cannot be performed with a negative number.)

(3) If (S) is an integer type, it is converted into a floating-point type before operation is performed.

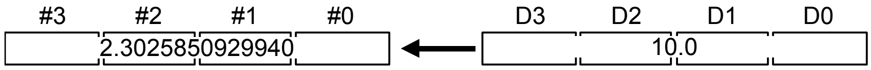
[Errors]

(1) An operation error will occur if:
- (S) is 0 or a negative number; or
- (S) is an indirectly specified device and its device No. is outside the range.

[Program examples]

(1) Program which finds the natural logarithm of D0F and substitutes the result to #0F

```
#0F = LN(D0F)
```



F/FS	G
○	○

7.6.9 Exponential operation : EXP

Format	EXP(S)

Number of basic steps	2

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S)	—	○	○	○	○	○	○	○	○	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S)	Data on which exponential operation will be performed	Floating-point type

[Functions]

(1) Exponential operation is performed on the base e data specified with (S).

(2) If (S) is an integer type, it is converted into a floating-point type before operation is performed.

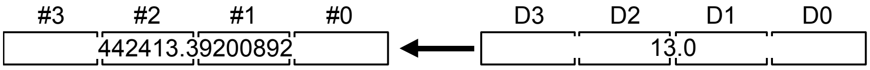
[Errors]

(1) An operation error will occur if:
- (S) is an indirectly specified device and its device No. is outside the range.

[Program examples]

(1) Program which performs exponential operation of D0F and substitutes the result to #0F

```
#0F = EXP(D0F)
```



F/FS	G
○	○

7.6.10 Absolute value : ABS

Format	ABS(S)

Number of basic steps	2

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S)	—	○	○	○	○	○	○	○	○	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S)	Data on which absolute value conversion will be performed	Data type of (S)

[Functions]

(1) The absolute value of the data specified with (S) is found.

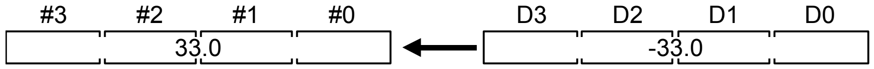
[Errors]

(1) An operation error will occur if:
- (S) is an indirectly specified device and its device No. is outside the range.

[Program examples]

(1) Program which finds the absolute value of D0F and substitutes the result to #0F

```
#0F = ABS(D0F)
```



F/FS	G
○	○

7.6.11 Round-off : RND

Format	RND(S)

Number of basic steps	2

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S)	—	○	○	○	○	○	○	○	○	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S)	Data whose fractional portion will be rounded off	Data type of (S)

[Functions]

(1) The rounded-off fractional portion value of the data specified with (S) is found.

(2) If (S) is a negative number, the absolute value of (S) is found and its fractional portion is rounded off and signed.

(3) If (S) is an integer type, its value is returned unchanged, with no conversion processing performed.

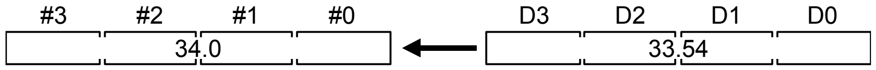
[Errors]

(1) An operation error will occur if:
- (S) is an indirectly specified device and its device No. is outside the range.

[Program examples]

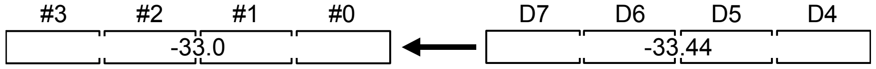
(1) Program which finds the rounded-off fractional portion value of D0F and substitutes the result to #0F

```
#0F = RND(D0F)
```



(2) Program which finds the rounded-off fractional portion value of D4F and substitutes the result to #0F (when D4F is a negative number)

```
#0F = RND(D4F)
```



F/FS	G
○	○

7.6.12 Round-down : FIX

Format	FIX(S)

Number of basic steps	2

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S)	—	○	○	○	○	○	○	○	○	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S)	Data whose fractional portion will be rounded down	Data type of (S)

[Functions]

(1) The largest integer not greater than the data specified with (S) is found.

(2) If the (S) value is positive, the absolute value will be smaller, and if it is negative, the absolute value will be greater.

(3) If (S) is an integer type, its value is returned unchanged, with no conversion processing performed.

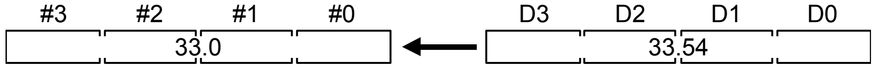
[Errors]

(1) An operation error will occur if:
- (S) is an indirectly specified device and its device No. is outside the range.

[Program examples]

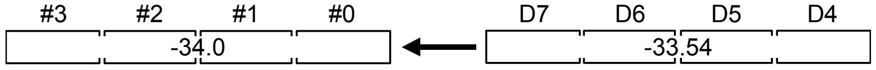
(1) Program which finds the rounded-down fractional portion value of D0F and substitutes the result to #0F

```
#0F = FIX(D0F)
```



(2) Program which finds the rounded-down fractional portion value of D4F and substitutes the result to #0F (when D4F is a negative number)

```
#0F = FIX(D4F)
```



F/FS	G
○	○

7.6.13 Round-up : FUP

Format	FUP(S)

Number of basic steps	2

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S)	—	○	○	○	○	○	○	○	○	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S)	Data whose fractional portion will be rounded up	Data type of (S)

[Functions]

(1) The smallest integer not less than the data specified with (S) is found.

(2) If the (S) value is positive, the absolute value will be greater, and if it is negative, the absolute value will be smaller.

(3) If (S) is an integer type, its value is returned unchanged, with no conversion processing performed.

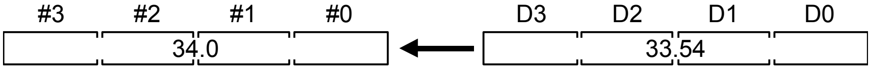
[Errors]

(1) An operation error will occur if:
- (S) is an indirectly specified device and its device No. is outside the range.

[Program examples]

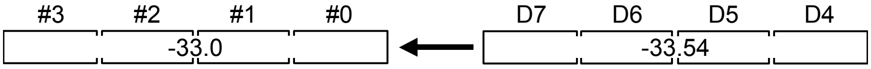
(1) Program which finds the rounded-up fractional portion value of D0F and substitutes the result to #0F

```
#0F = FUP(D0F)
```



(2) Program which finds the rounded-up fractional portion value of D4F and substitutes the result to #0F (when D4F is a negative number)

```
#0F = FUP(D4F)
```



F/FS	G
○	○

7.6.14 BCD → BIN conversion : BIN

Format	BIN(S)

Number of basic steps	2

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S)	—	○	○	—	○	○	○	—	○	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S)	BCD data which will be converted into BIN data	Data type of (S) (Integer type)

[Functions]

(1) The BCD data specified with (S) is converted into BIN data.

(2) If (S) is a 16-bit integer type, the data range is 0 to 9999.

(3) If (S) is a 32-bit integer type, the data range is 0 to 99999999.

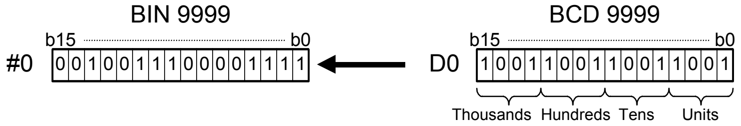
[Errors]

(1) An operation error will occur if:
- A value other than 0 to 9 is in any digit of (S); or
- (S) is an indirectly specified device and its device No. is outside the range.

[Program examples]

(1) Program which converts the BCD data of D0 into BIN data and substitutes the result to #0

```
#0 = BIN(D0)
```



F/FS	G
○	○

7.6.15 BIN → BCD conversion : BCD

Format	BCD(S)

Number of basic steps	2

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S)	—	○	○	—	○	○	○	—	○	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S)	BIN data which will be converted into BCD data	Data type of (S) (Integer type)

[Functions]

(1) The BIN data specified with (S) is converted into BCD data.

(2) If (S) is a 16-bit integer type, the data range is 0 to 9999.

(3) If (S) is a 32-bit integer type, the data range is 0 to 99999999.

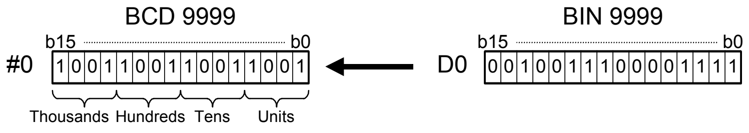
[Errors]

(1) An operation error will occur if:
- The data is other than 0 to 9999 when (S) is a 16-bit integer type;
- The data is other than 0 to 99999999 when (S) is a 32-bit integer type; or
- (S) is an indirectly specified device and its device No. is outside the range.

[Program examples]

(1) Program which converts the BIN data of D0 into BCD data and substitutes the result to #0

```
#0 = BCD(D0)
```



F/FS	G
○	○

7.7 Type Conversions

7.7.1 Signed 16-bit integer value conversion : SHORT

Format	SHORT(S)

Number of basic steps	2

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S)	—	○	○	○	○	○	○	○	○	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S)	Data which will be converted into signed 16-bit integer value	16-bit integer type

[Functions]

(1) The data specified with (S) is converted into a signed 16-bit integer value.

(2) The data range of (S) is -32768 to 32767.

(3) When (S) is a 64-bit floating-point type, its fractional portion is rounded down before conversion is made.

(4) If (S) is a 16-bit integer type, its value is returned unchanged, with no conversion processing performed.

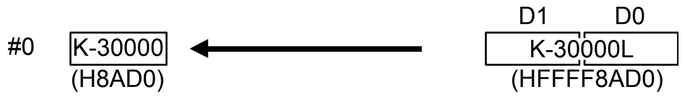
[Errors]

(1) An operation error will occur if:
- The (S) data is outside the range -32768 to 32767; or
- (S) is an indirectly specified device and its device No. is outside the range.

[Program examples]

(1) Program which converts the data of D0L into a signed 16-bit integer value and substitutes the result to #0

```
#0 = SHORT(D0L)
```



F/FS	G
○	○

7.7.2 Unsigned 16-bit integer value conversion : USHORT

Format	USHORT(S)

Number of basic steps	2

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S)	—	○	○	○	○	○	○	○	○	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S)	Data which will be converted into unsigned 16-bit integer value	16-bit integer type

[Functions]

(1) The data specified with (S) is converted into an unsigned 16-bit integer value.

(2) The data range of (S) is 0 to 65535.

(3) When (S) is a 64-bit floating-point type, its fractional portion is rounded down before conversion is made.

(4) If (S) is a 16-bit integer type, its value is returned unchanged, with no conversion processing performed.

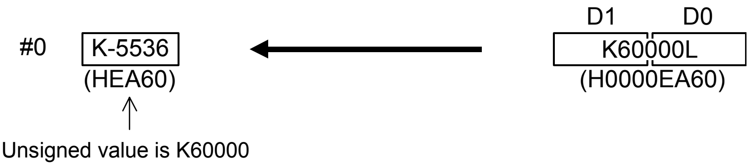
[Errors]

(1) An operation error will occur if:
- The (S) data is outside the range 0 to 65535; or
- (S) is an indirectly specified device and its device No. is outside the range.

[Program examples]

(1) Program which converts the data of D0L into an unsigned 16-bit integer value and substitutes the result to #0

```
#0 = USHORT(D0L)
```



F/FS	G
○	○

7.7.3 Signed 32-bit integer value conversion : LONG

Format	LONG(S)

Number of basic steps	2

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S)	—	○	○	○	○	○	○	○	○	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S)	Data which will be converted into signed 32-bit integer value	32-bit integer type

[Functions]

(1) The data specified with (S) is converted into a signed 32-bit integer value.

(2) The data range of (S) is -2147483648 to 2147483647.

(3) When (S) is a 64-bit floating-point type, its fractional portion is rounded down before conversion is made.

(4) If (S) is a 32-bit integer type, its value is returned unchanged, with no conversion processing performed.

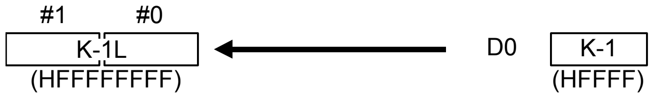
[Errors]

(1) An operation error will occur if:
- The (S) data is outside the range -2147483648 to 2147483647; or
- (S) is an indirectly specified device and its device No. is outside the range.

[Program examples]

(1) Program which converts the data of D0 into a signed 32-bit integer value and substitutes the result to #0L

```
#0L = LONG(D0)
```



F/FS	G
○	○

7.7.4 Unsigned 32-bit integer value conversion : ULONG

Format	ULONG(S)

Number of basic steps	2

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S)	—	○	○	○	○	○	○	○	○	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S)	Data which will be converted into unsigned 32-bit integer value	32-bit integer type

[Functions]

(1) The data specified with (S) is converted into an unsigned 32-bit integer value.

(2) The data range of (S) is 0 to 4294967295.

(3) When (S) is a 64-bit floating-point type, its fractional portion is rounded down before conversion is made.

(4) If (S) is a 32-bit integer type, its value is returned unchanged, with no conversion processing performed.

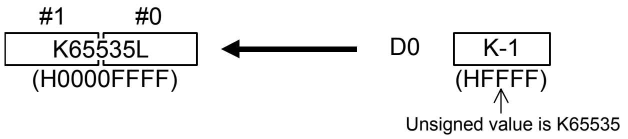
[Errors]

(1) An operation error will occur if:
- The (S) data is outside the range 0 to 4294967295; or
- (S) is an indirectly specified device and its device No. is outside the range.

[Program examples]

(1) Program which converts the data of D0 into an unsigned 32-bit integer value and substitutes the result to #0L

```
#0L = ULONG(D0)
```



F/FS	G
○	○

7.7.5 Signed 64-bit floating-point value conversion : FLOAT

Format	FLOAT(S)

Number of basic steps	2

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S)	—	○	○	○	○	○	○	○	○	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S)	Data which will be converted into signed 64-bit floating-point value	64-bit floating-point type

[Functions]

(1) The data specified with (S) is converted into a signed 64-bit floating-point value.

(2) If (S) is a 64-bit floating-point type, its value is returned unchanged, with no conversion processing performed.

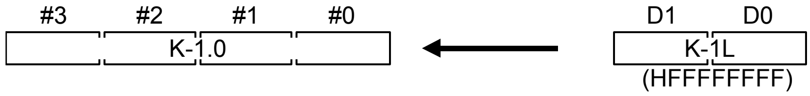
[Errors]

(1) An operation error will occur if:
- (S) is an indirectly specified device and its device No. is outside the range.

[Program examples]

(1) Program which converts the data of D0L into a signed 64-bit floating-point value and substitutes the result to #0F

```
#0F = FLOAT(D0L)
```



F/FS	G
○	○

7.7.6 Unsigned 64-bit floating-point value conversion : UFLOAT

Format	UFLOAT(S)

Number of basic steps	2

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S)	—	○	○	○	○	○	○	○	○	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S)	Data which will be converted into unsigned 64-bit floating-point value	64-bit floating-point type

[Functions]

(1) The data specified with (S) is converted into an unsigned 64-bit floating-point value.

(2) If (S) is a 64-bit floating-point type, its value is returned unchanged, with no conversion processing performed.

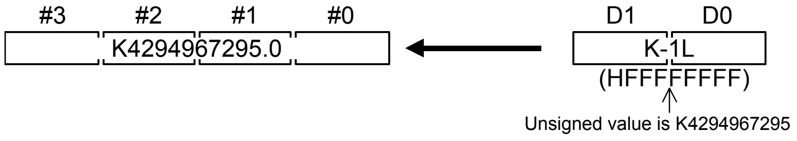
[Errors]

(1) An operation error will occur if:
- (S) is an indirectly specified device and its device No. is outside the range.

[Program examples]

(1) Program which converts the data of D0L into an unsigned 64-bit floating-point value and substitutes the result to #0F

```
#0F = UFLOAT(D0L)
```



F/FS	G
○	○

7.8 Bit Device Statuses

7.8.1 ON (Normally open contact) : (None)

Format	(S)

Number of basic steps	2

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S)	○	—	—	—	—	—	—	—	—	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S)	Bit device used in bit conditional expression	Logical type (true/false)

[Functions]

(1) True is returned when the bit device specified with (S) in a bit conditional expression is ON (1), or false is returned when that bit device is OFF (0).

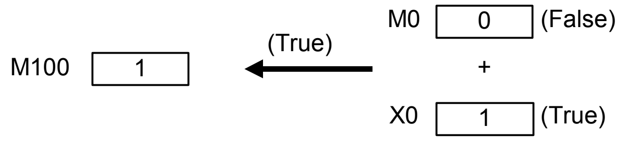
[Errors]

(1) An operation error will occur if:
- (S) is an indirectly specified device and its device No. is outside the range.

[Program examples]

(1) Program which sets M100 when either of M0 and X0 is ON (1)

```
SET M100 = M0 + X0
```



F/FS	G
○	○

7.8.2 OFF (Normally closed contact) : !

Format	!(S)

Number of basic steps	2

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S)	○	—	—	—	—	—	—	—	—	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S)	Bit device used in bit conditional expression	Logical type (true/false)

[Functions]

(1) True is returned when the bit device specified with (S) in a bit conditional expression is OFF (0), or false is returned when that bit device is ON (1).

[Errors]

(1) An operation error will occur if:

- (S) is an indirectly specified device and its device No. is outside the range.

[Program examples]

(1) Program which resets M100 when M0 is OFF (0)

```
RST M100 = !M0
```

M100 0 ← !M0 0 (True)

F/FS	G
○	○

7.9 Bit Device Controls

7.9.1 Device set : SET

Format	SET(D)=(S)

Number of basic steps	4

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(D)	○	—	—	—	—	—	—	—	—	—	—
(S)	○	—	—	—	—	—	—	—	—	○	○

○ : Usable

(Note-1) : PX is write-disabled and cannot be used at (D).
(Note-2) : M2001 to M2032 cannot be used at (D).

[Setting data]

Setting data	Description	Data type of result
(D)	Bit data for device set	Bit logical type (true/false)
(S)	Condition data which determines whether device set will be performed or not	

[Functions]

(1) If the data specified with (S) is true, the bit data specified with (D) is set.

(2) (S) can be omitted.
At this time, the format is "SET(D)" and device set is made unconditionally.

(3) When this instruction is set as a transition condition in the last block of a transient program, whether the data specified with (S) is true or false is returned as logical type data. In this case, (S) cannot be omitted.

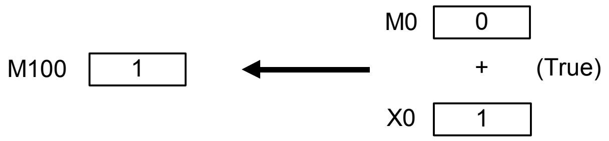
[Errors]

(1) An operation error will occur if:
- (D) or (S) is an indirectly specified device and its device No. is outside the range.

[Program examples]

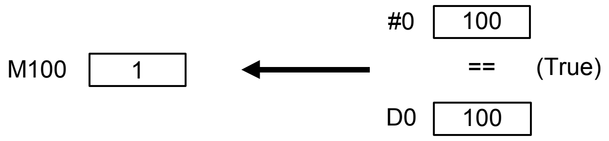
(1) Program which sets M100 when either of M0 and X0 is 1

```
SET M100 = M0 + X0
```



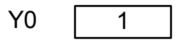
(2) Program which sets M100 when #0 is equal to D0

```
SET M100 = #0 = = D0
```



(3) Program which sets Y0 unconditionally

```
SET Y0
```



F/FS	G
○	○

7.9.2 Device reset : RST

Format	RST(D)=(S)

Number of basic steps	4

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(D)	○	—	—	—	—	—	—	—	—	—	—
(S)	○	—	—	—	—	—	—	—	—	○	○

○ : Usable

(Note-1) : PX is write-disabled and cannot be used at (D).
(Note-2) : M2001 to M2032 cannot be used at (D).

[Setting data]

Setting data	Description	Data type of result
(D)	Bit data for device reset	Bit logical type (true/false)
(S)	Condition data which determines whether device reset will be performed or not	

[Functions]

(1) If the data specified with (S) is true, the bit data specified with (D) is reset.

(2) (S) can be omitted.
At this time, the format is "RST(D)" and device reset is made unconditionally.

(3) When this instruction is set as a transition condition in the last block of a transient program, whether the data specified with (S) is true or false is returned as logical type data. In this case, (S) cannot be omitted.

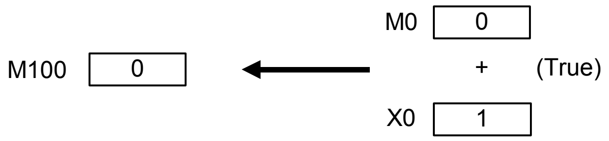
[Errors]

(1) An operation error will occur if:
- (D) or (S) is an indirectly specified device and its device No. is outside the range.

[Program examples]

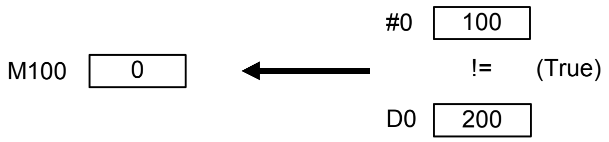
(1) Program which resets M100 when either of M0 and X0 is 1

```
RST M100 = M0 + X0
```



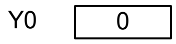
(2) Program which resets M100 when #0 is equal to D0

```
RST M100 = #0 != D0
```



(3) Program which resets Y0 unconditionally

```
RST Y0
```



F/FS	G
○	○

7.9.3 Device output : DOUT

Format	DOUT(D), (S)

Number of basic steps	4

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(D)	○	—	—	—	—	—	—	—	—	—	—
(S)	—	○	○	—	○	○	○	—	○	—	—

○ : Usable

(Note-1) : PX and special M cannot be used at (D).

(Note-2) : Range including M2000 to M2127 cannot be used at (D).

[Setting data]

Setting data	Description	Data type of result
(D)	Output destination bit data	Batch bit
(S)	Output source data	

[Functions]

(1) The data specified with (S) is output to the bit data specified with (D).

(2) Specify a multiple of 16 as the device No. of the bit data specified with (D).

(3) If the type of (S) is a 16-bit integer type, 16 points of the (S) data, starting at the least significant bit, are output in order to the bit devices headed by the one specified with (D).

(4) If the type of (S) is a 32-bit integer type, 32 points of the (S) data, starting at the least significant bit, are output in order to the bit devices headed by the one specified with (D).

[Errors]

(1) An operation error will occur if:
- (D) or (S) is an indirectly specified device and its device No. is outside the range.
- (D) is an indirectly specified device and its device No. is not a multiple of 16.

[Program examples]

(1) Program which outputs the data of D0 to Y0-YF

```
DOUT Y0, D0
```

YF															Y0
0	0	1	0	0	1	1	1	0	0	0	0	1	1	1	1

←

D0

b15															b0
0	0	1	0	0	1	1	1	0	0	0	0	1	1	1	1

F/FS	G
○	○

7.9.4 Device input : DIN

Format	DIN(D), (S)

Number of basic steps	4

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(D)	—	○	○	—	—	—	—	—	—	—	—
(S)	○	—	—	—	—	—	—	—	—	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(D)	Input destination data	Data type of (D) (Integer type)
(S)	Input source bit data	

[Functions]

(1) The bit data specified with (S) is input to the data specified with (D).

(2) Specify a multiple of 16 as the device No. of the bit data specified with (S).

(3) If the type of (D) is a 16-bit integer type, 16 points of the (D) data, starting at the least significant bit, are input in order to the bit devices headed by the one specified with (S).

(4) If the type of (D) is a 32-bit integer type, 32 points of the (D) data, starting at the least significant bit, are input in order to the bit devices headed by the one specified with (S).

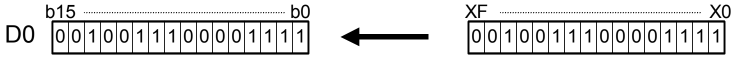
[Errors]

(1) An operation error will occur if:
- (D) or (S) is an indirectly specified device and its device No. is outside the range.
- (S) is an indirectly specified device and its device No. is not a multiple of 16.

[Program examples]

(1) Program which inputs the data of X0-XF to D0

```
DIN D0, X0
```



```
     b15 ........................ b0          XF ........................ X0
D0  |0|0|1|0|0|1|1|1|0|0|0|0|1|1|1|1|  <----  |0|0|1|0|0|1|1|1|0|0|0|0|1|1|1|1|
```

F/FS	G
○	○

7.9.5 Bit device output : OUT

Refer to the Section "1.3.4" for the correspondence version of the Motion CPU and the software.

Format	OUT(D)=(S)

Number of basic steps	4

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(D)	○	—	—	—	—	—	—	—	—	—	—
(S)	○	—	—	—	—	—	—	—	—	○	○

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(D)	Bit device for device output	Bit logical type (true/false)
(S)	Condition data which determines device output	

[Functions]

(1) If the data specified with (S) is true, the bit data specified with (D) is set, and if the data specified with (S) is false, the bit data specified with (D) is reset.

(2) When this instruction is set as a transition condition in the last block of a transient program, whether the data specified with (S) is true or false is returned as logical type data.

(3) In this case, (S) cannot be omitted.

[Errors]

(1) An operation error will occur if:
- (D) or (S) is an indirectly specified device and its device No. is outside the range.

[Program examples]

(1) Program which sets M100 when M0 is ON (1) and program which resets M100 when M0 is OFF (0)

```
OUT M100 = M0
```

(2) Program which sets M100 when M0 and M1 are both on and resets M100 except it

```
OUT M100 = M0 * M1
```

(3) Program which sets M100 when D0 is equal to D2000 and resets M100 when D is not equal to D2000

```
OUT M100 = (D0 == D2000)
```

F/FS	G
○	○

7.10 Logical Operations

7.10.1 Logical acknowledgement : (None)

Format	(S)

Number of basic steps	—

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S)	○	—	—	—	—	—	—	—	—	○	○

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S)	Data which will be logically acknowledged	Logical type (true/false)

[Functions]

(1) Whether the logical type data specified with (S) is true or false is returned unchanged. (Logical acknowledgement)

[Errors]

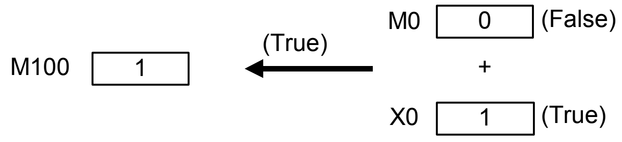
(1) An operation error will occur if:

- (S) is an indirectly specified device and its device No. is outside the range.

[Program examples]

(1) Program which sets M100 when either of M0 and X0 is ON (1)

```
SET M100 = M0 + X0
```



F/FS	G
○	○

7.10.2 Logical negation : !

Format	! (S)

Number of basic steps	2

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S)	○	—	—	—	—	—	—	—	—	○	○

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S)	Data which will be logically negated	Logical type (true/false)

[Functions]

(1) The data specified with (S) is logically negated.

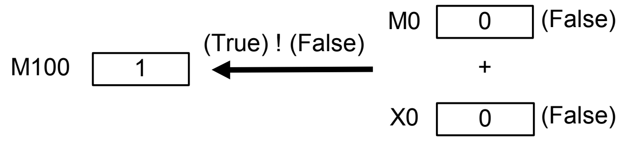
[Errors]

(1) An operation error will occur if:
- (S) is an indirectly specified device and its device No. is outside the range.

[Program examples]

(1) Program which sets M100 when "either of M0 and X0 is not ON (1)" (when M0 and X0 are both OFF (0))

```
SET M100 = ! (M0 + X0)
```



F/FS	G
○	○

7.10.3 Logical AND : *

Format	(S1)*(S2)

Number of basic steps	4

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S1)	○	—	—	—	—	—	—	—	—	○	○
(S2)	○	—	—	—	—	—	—	—	—	○	○

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S1)	Data which will be ANDed	Logical type (true/false)
(S2)		

[Functions]

(1) The data specified with (S1) and the data specified with (S2) are ANDed.

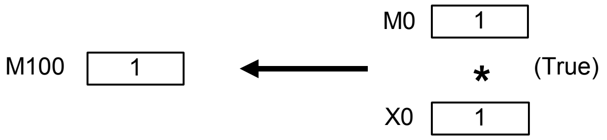
[Errors]

(1) An operation error will occur if:
- (S) is an indirectly specified device and its device No. is outside the range.

[Program examples]

(1) Program which sets M100 when M0 and X0 are both 1

```
SET M100 = M0*X0
```



F/FS	G
○	○

7.10.4 Logical OR : +

Format	(S1)+(S2)

Number of basic steps	4

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S1)	○	—	—	—	—	—	—	—	—	○	○
(S2)	○	—	—	—	—	—	—	—	—	○	○

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S1)	Data which will be ORed	Logical type (true/false)
(S2)		

[Functions]

(1) The data specified with (S1) and the data specified with (S2) are ORed.

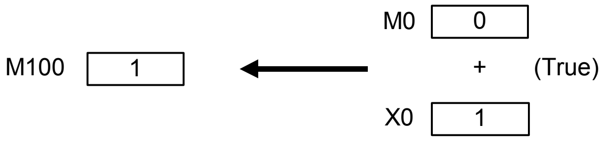
[Errors]

(1) An operation error will occur if:
- (S1) or (S2) is an indirectly specified device and its device No. is outside the range.

[Program examples]

(1) Program which sets M100 when either of M0 and X0 is 1

```
SET M100 = M0 + X0
```



F/FS	G
○	○

7.11 Comparison Operations

7.11.1 Equal to : ==

Format	(S1)==(S2)

Number of basic steps	4

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S1)	—	○	○	○	○	○	○	○	○	—	—
(S2)	—	○	○	○	○	○	○	○	○	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S1)	Data which will be compared	Logical type (true/false)
(S2)		

[Functions]

(1) The data specified with (S1) and the data specified with (S2) are compared, and the result is true if they are equal.

(2) When (S1) and (S2) differ in data type, the data of the smaller data type is converted into that of the greater type before comparison is performed.

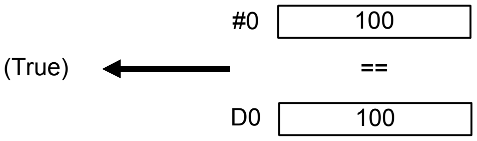
[Errors]

(1) An operation error will occur if:
- (S1) or (S2) is an indirectly specified device and its device No. is outside the range.

[Program examples]

(1) Program which compares whether #0 and D0 are equal or not

```
#0 = = D0
```



F/FS	G
○	○

7.11.2 Not equal to : !=

Format	(S1)!=(S2)

Number of basic steps	4

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S1)	—	○	○	○	○	○	○	○	○	—	—
(S2)	—	○	○	○	○	○	○	○	○	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S1)	Data which will be compared	Logical type (true/false)
(S2)		

[Functions]

(1) The data specified with (S1) and the data specified with (S2) are compared, and the result is true if they are not equal.

(2) When (S1) and (S2) differ in data type, the data of the smaller data type is converted into that of the greater type before comparison is performed.

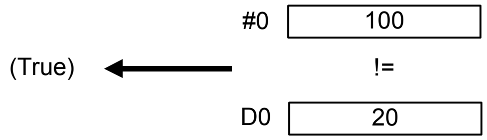
[Errors]

(1) An operation error will occur if:
- (S1) or (S2) is an indirectly specified device and its device No. is outside the range.

[Program examples]

(1) Program which compares whether #0 and D0 are unequal or not

```
#0 != D0
```



F/FS	G
○	○

7.11.3 Less than : <

Format	(S1)<(S2)

Number of basic steps	4

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S1)	—	○	○	○	○	○	○	○	○	—	—
(S2)	—	○	○	○	○	○	○	○	○	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S1)	Data which will be compared	Logical type (true/false)
(S2)		

[Functions]

(1) The result is true if the data specified with (S1) is less than the data specified with (S2).

(2) When (S1) and (S2) differ in data type, the data of the smaller data type is converted into that of the greater type before comparison is performed.

[Errors]

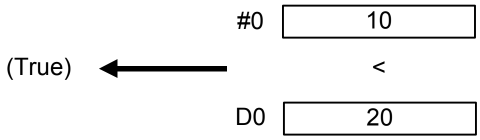
(1) An operation error will occur if:

- (S1) or (S2) is an indirectly specified device and its device No. is outside the range.

[Program examples]

(1) Program which compares whether #0 is less than D0 or not

```
#0 < D0
```



F/FS	G
○	○

7.11.4 Less than or equal to: <=

Format	(S1)<=(S2)

Number of basic steps	4

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S1)	—	○	○	○	○	○	○	○	○	—	—
(S2)	—	○	○	○	○	○	○	○	○	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S1)	Data which will be compared	Logical type (true/false)
(S2)		

[Functions]

(1) The result is true if the data specified with (S1) is less than or equal to the data specified with (S2).

(2) When (S1) and (S2) differ in data type, the data of the smaller data type is converted into that of the greater type before comparison is performed.

[Errors]

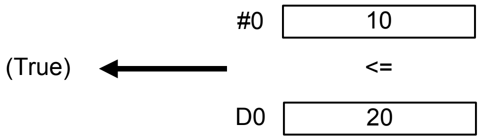
(1) An operation error will occur if:

- (S1) or (S2) is an indirectly specified device and its device No. is outside the range.

[Program examples]

(1) Program which compares whether #0 is less than or equal to D0 or not

```
#0 <= D0
```



F/FS	G
○	○

7.11.5 More than : >

Format	(S1)>(S2)

Number of basic steps	4

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S1)	—	○	○	○	○	○	○	○	○	—	—
(S2)	—	○	○	○	○	○	○	○	○	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S1)	Data which will be compared	Logical type (true/false)
(S2)		

[Functions]

(1) The result is true if the data specified with (S1) is greater than the data specified with (S2).

(2) When (S1) and (S2) differ in data type, the data of the smaller data type is converted into that of the greater type before comparison is performed.

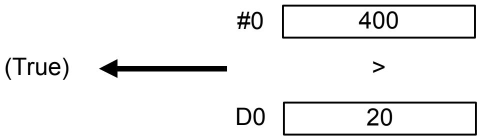
[Errors]

(1) An operation error will occur if:
- (S1) or (S2) is an indirectly specified device and its device No. is outside the range.

[Program examples]

(1) Program which compares whether #0 is greater than D0 or not

```
#0 > D0
```



F/FS	G
○	○

7.11.6 More than or equal to: >=

Format	(S1)>=(S2)

Number of basic steps	4

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S1)	—	○	○	○	○	○	○	○	○	—	—
(S2)	—	○	○	○	○	○	○	○	○	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S1)	Data which will be compared	Logical type (true/false)
(S2)		

[Functions]

(1) The result is true if the data specified with (S1) is greater than or equal to the data specified with (S2).

(2) When (S1) and (S2) differ in data type, the data of the smaller data type is converted into that of the greater type before comparison is performed.

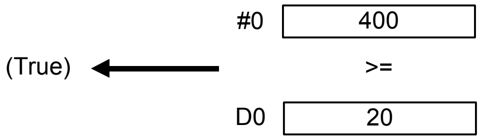
[Errors]

(1) An operation error will occur if:
- (S1) or (S2) is an indirectly specified device and its device No. is outside the range.

[Program examples]

(1) Program which compares whether #0 is greater than or equal to D0 or not

```
#0 >= D0
```



F/FS	G
○	○

7.12 Motion-Dedicated Functions (CHGV, CHGT)

7.12.1 Speed change request : CHGV

Format	CHGV((S1), (S2))

Number of basic steps	4

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S1)	—	—	—	—	—	○	—	—	—	—	—
(S2)	—	○	○	—	—	○	○	—	○	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S1)	Axis No. to which speed change request will be given	—
(S2)	Specified speed	

[Functions]

(1) A speed change is made in the following procedure.
  (a) The speed changing flag (M2061 to M2092) correspond to the axis specified with (S1) is turned ON.
  (b) The speed of the axis specified with (S1) is changed to the speed specified with (S2).
  (c) The speed changing flag is turned OFF.

(2) The axis No. that may be set at (S1) is within the following range.

Q172CPU(N)	Q173CPU(N)
1 to 8	1 to 32

For interpolation control, set any one of the interpolation axes. When linear interpolation control is exercised, a speed change varies as described below with the positioning speed designation method set in the servo program.

Positioning speed designation method	Operation
Combined speed designation	Speed change is made so that the combined speed becomes the speed specified with (S2).
Longest axis designation	Speed change is made so that the longest axis speed becomes the speed specified with (S2).
Reference axis speed designation	Speed change is made so that the reference axis speed becomes the speed specified with (S2).

(3) Operation varies with the sign of the specified speed set at (S2).

Sign of specified speed	Operation
Positive	Speed change
0	Temporary stop
Negative	Return

(4) The specified speed that may be set at (S2) is within the following range.

(a) Real mode

	mm		inch		degree		PLS	
	Setting range	Unit	Setting range	Unit	Setting range	Unit	Setting range	Unit
Speed change request	0 to 600000000	$\times 10^{-2}$ mm/min	0 to 600000000	$\times 10^{-3}$ inch/min	0 to 2147483647	$\times 10^{-3}$ degree/min	0 to 10000000	PLS/s
Return request	-1 to -600000000	$\times 10^{-2}$ mm/min	-1 to -600000000	$\times 10^{-3}$ inch/min	-1 to -2147483647	$\times 10^{-3}$ degree/min	-1 to -10000000	PLS/s

(b) Virtual mode

	PLS	
	Setting range	Unit
Speed change request	0 to 10000000	PLS/s
Return request	-1 to -10000000	PLS/s

(5) The speed changed by CHGV instruction is effective only on the servo program during starting.

(6) By specifying a negative speed and making a speed change request during the start, allows the axis to start deceleration at that point and return in the opposite direction upon completion of deceleration.
The following operations by the servo instruction are shown below.

Control mode	Servo instruction	Operation
Linear control	ABS−1 INC−1 ABS−2 INC−2 ABS−3 INC−3 ABS−4 INC−4	On completion of deceleration, the axis reverses its moving direction, returns to the positioning starting point at the absolute value of the specified speed, and stops (waits) there. For circular interpolation, the axis returns in the circular path.
Circular interpolation control	ABS circular INC circular	
Fixed-pitch feed	FEED−1 FEED−2 FEED−3	
Constant-speed control	CPSTART1 CPSTART2 CPSTART3 CPSTART4	On completion of deceleration, the axis reverses its moving direction, returns to the preceding point at the absolute value of the specified speed, and stops (waits) there.
Speed control (I)	VF VR	On completion of deceleration, the axis reverses its moving direction at the absolute value of the specified speed. The axis does not stop until a stop instruction is input.
Speed control (II)	VVF VVR	
Speed/position control	VPF VPR VPSTART	The axis cannot return. The speed change request is regarded as a normal speed change request. Minor error [305] (Note) will occur and the axis will be controlled at the speed limit value.
Position follow-up control	PFSTART	
Speed switching control	VSTART	
JOG operation		
High-speed oscillation	OSC	A speed change cannot be made. Minor error [310] (Note) will occur.
Home position return	ZERO	A speed change cannot be made. Minor error [301] (Note) will occur.

(Note) : Minor error [301] : A speed change was made during home position return.
Minor error [305] : The setting speed is outside the range of 0 to speed limit value.
Minor error [310] : A speed change was made during high-speed oscillation.

[Controls]

(a) If a speed change is made to a negative speed, control is executed with the control mode during the start as indicated in the above table.

(b) The returning command speed is the absolute value of a new speed.

(c) When the axis is waiting at the return position

1) Signal states (n : Axis No., m : Axis No. –1)
- Start accept (M2000+n) ON (unchanged from before execution of CHGV instruction)
- Positioning start completion (M2400+20m) ON (unchanged from before execution of CHGV instruction)
- Positioning completion (M2401+20m) OFF
- In-position (M2402+20m) ON
- Command in-position (M2403+20m) OFF
- Speed change "0" accepting flag (M2240+m) ON

2) Make a speed change to a positive speed for a restart.

3) Turn on the stop command to end the positioning.

4) A negative speed change made again will be ignored.

(d) While the axis is reversion in the speed control mode

1) Make a speed change to a positive speed to change the travel direction again.
2) Turn ON the stop command to make a stop.
3) A speed change is made in the opposite direction if a negative speed change is made again.

[Errors]

(1) An operation error will occur and a speed change will not be made if:

- The specified axis No. of (S1) is outside the range.
- (S2) is an indirectly specified device and its device No. is outside the range.

(2) A minor error will occur and a speed change will not be made if:

- The axis specified with (S1) is home position return (Minor error: 301).
- The axis specified with (S1) is decelerating (Minor error: 303).

(3) A minor error will occur and the axis to be controlled at the speed limit value if:

- The absolute value of the speed specified with (S2) is greater than the speed limit value. (Minor error: 305)

POINT

If the absolute value of a negative new speed is higher than the speed specified with the servo program during constant-speed control, return control is exercised at the speed specified in the program (speed clamp control for a speed change during constant-speed control).
At this time, an error will not occur.

[Program examples]

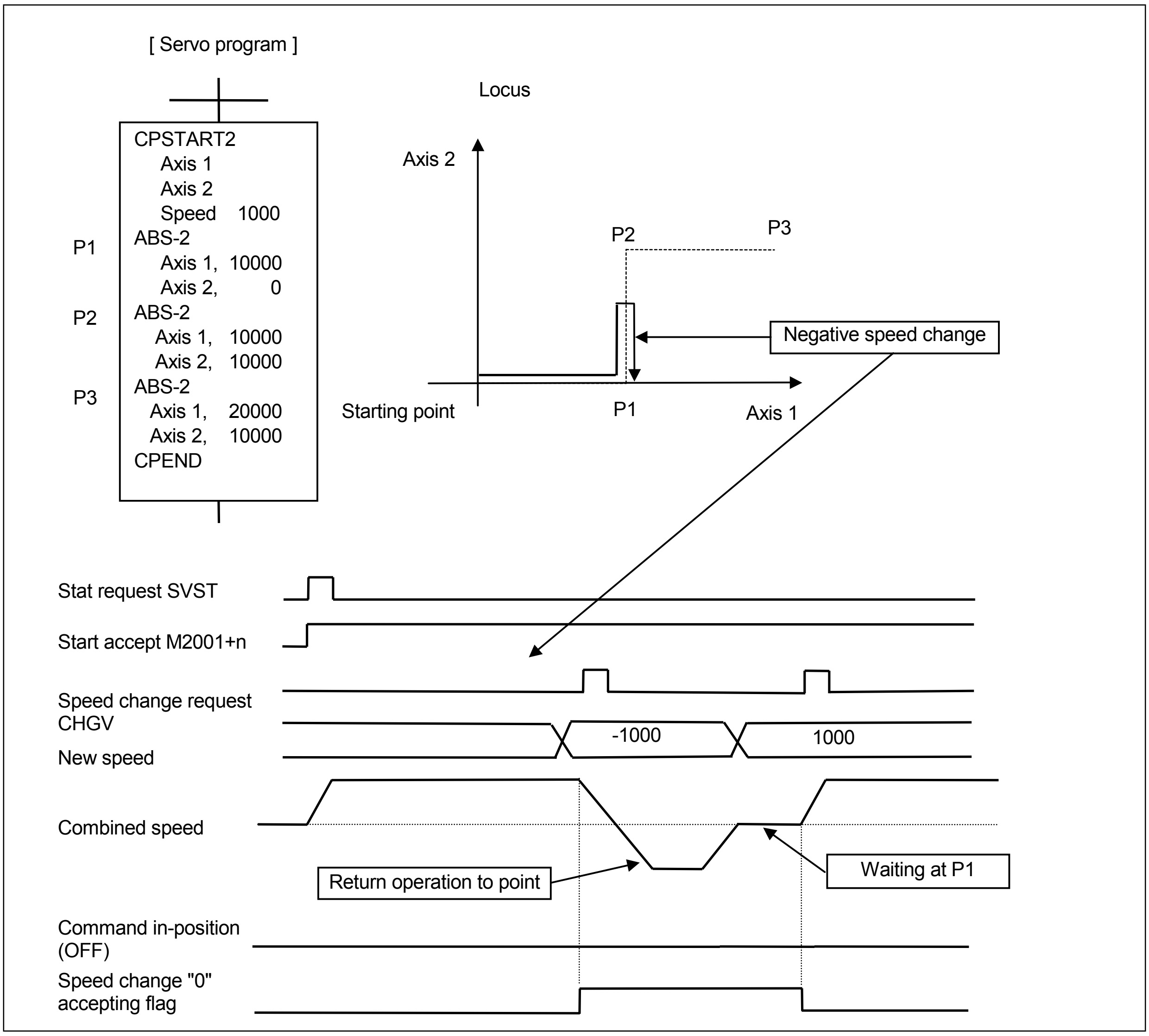
(1) Program which changes the positioning speed of axis 2

```
CHGV(K2,K10)
```

(2) Return program which changes the positioning speed of axis 1 to a negative value

```
CHGV(K1,K－1000)
```

The following operation will be performed when a return request is made in constant-speed control.



If a speed change to a negative speed is made during execution of positioning to P2 as shown above, the axis returns to P1 along the program specified locus and waits at P1.

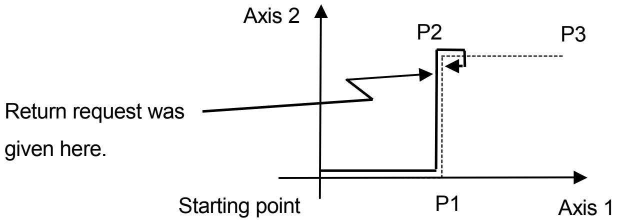
POINT

(1) A speed change may be invalid if it is made from when a servo program start request is made until the "positioning start completion signal" status changes to ON. When making a speed change at almost the same timing as a start, always create a program which will execute the speed change after the "positioning start completion signal" has turned ON.

(2) A return request, which is made while the axis is at a stop waiting for FIN using the M code FIN signal waiting function during constant-speed control, will be ignored.

(3) In the above example, if a return request is given right before P2 and the axis passes through P2 during deceleration, the axis will return to P2.

(4) There will be a delay of time equivalent to an operation cycle at the maximum in the response time from when the CHGV instruction is executed until the speed begins to change actually.



F/FS	G
○	○

7.12.2 Torque limit value change request : CHGT

Format	CHGT((S1), (S2))

Number of basic steps	4

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S1)	—	—	—	—	—	○	—	—	—	—	—
(S2)	—	○	○	—	—	○	○	—	○	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S1)	Axis No. to which torque limit value change request will be given	—
(S2)	Specified torque limit value	

[Functions]

(1) The torque limit value of the axis specified with (S1) is changed to the torque limit value axis specified with (S2).

(2) In the real mode, any axis that has completed a servo startup can be changed in torque limit value any time, independently of the status, starting, stopping, servo ON or servo OFF.

(3) The axis No. that may be set at (S1) is within the following range.

Q172CPU(N)	Q173CPU(N)
1 to 8	1 to 32

(4) The torque limit value that may be set at (S2) is within the range 1 to 500[%].

(5) The torque limit value specified here and the one specified in the servo program have the following relationships.

At start

At a normal start, the torque limit value is given to the servo of the start axis according to "P. torque" set in the servo program or the "torque limit value" of the specified parameter block.
For an interpolation start, the torque limit value is given to the number of axes to be interpolated.

↓

Executing the CHGT instruction gives the preset torque limit value to only the specified axis.

↓

Thereafter, the torque limit value given to the servo at a servo program start or JOG start is made valid only when it is lower than the torque limit value specified in CHGT.
This torque limit value clamp processing is performed per axis.

During start

(a) If the following torque limit value has been set, it will not be changed to higher than the torque limit value specified in the CHGT instruction.
- Torque limit value at a midway point in constant-speed control or speed switching control
- Torque limit value at the point of switching to position control in speed/ position changing control
- Torque limit value in speed control

(b) The CHGT instruction accepts a torque limit value which is higher than the torque limit value set in the servo program or parameter block.

(6) The torque limit value changed by CHGT instruction is effective only during power supply is on.

[Errors]

(1) An operation error will occur and a torque limit value change will not be made if:
- The specified axis No. at (S1) is outside the range; or
- (S2) is an indirectly specified device and its device No. is outside the range.

(2) A minor error will occur and a torque limit value change will not be made if:
- The torque limit value specified with (S2) is outside the range 1 to 500[%] (Minor error: 311); or
- The CHGT instruction is executed for any axis that has not yet been started (Minor error: 312).

[Program examples]

(1) Program which changes the torque limit value of axis 2

```
CHGT(K2,K10)
```

POINT

(1) CHGT instruction is invalid (ignored) during the virtual mode. When changing the torque limit value during operation in the virtual mode, set the "torque limit value setting device" in the output module parameter of the mechanical system program.

(2) There will be a delay of time equivalent to an operation cycle at the maximum in the response time from when the CHGT instruction is executed until the torque limit value is changed actually.

F/FS	G
○	○

7.13 Other Instructions

7.13.1 Event task enable : EI

Format	EI

Number of basic steps	1

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
—	—	—	—	—	—	—	—	—	—	—	—

○ : Usable

[Setting data]

There are no setting data.

[Functions]

(1) The execution of an event task is enabled.

(2) This instruction is usable with a normal task only.

[Errors]

(1) An operation error will occur if:
- This instruction is used with other than a normal task.

[Program examples]

(1) Enables the execution of an event task.

```
EI
```

F/FS	G
○	○

7.13.2 Event task disable : DI

Format	DI

Number of basic steps	1

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
—	—	—	—	—	—	—	—	—	—	—	—

○ : Usable

[Setting data]

There are no setting data.

[Functions]

(1) The execution of an event task is disabled.

(2) If an external interrupt or PLC interrupt occurs after execution of the DI instruction, the corresponding event task is executed once at the execution of the EI instruction. (If two or more external interrupts or PLC interrupts occur during DI, the corresponding event task is executed only once at the execution of the EI instruction.)

(3) During DI, a fixed-cycle event task is not executed.

(4) The execution of an NMI task cannot be disabled.

(5) The DI status is established at power-on or when a reset is made with the RESET/L.CLR switch.

[Errors]

(1) An operation error will occur if:
- This instruction is used with other than a normal task.

[Program examples]

(1) Program which disables the execution of an event task.

```
DI
```

F/FS	G
○	○

7.13.3 No operation : NOP

Format	NOP

Number of basic steps	1

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
—	—	—	—	—	—	—	—	—	—	—	—

○ : Usable

[Setting data]

There are no setting data.

[Functions]

(1) This is a no-operation instruction and does not affect the preceding operations.

[Errors]

(1) There are no operation errors for no operation: NOP.

F/FS	G
○	○

7.13.4 Block transfer : BMOV

Refer to the Section "1.3.4" for the correspondence version of the Motion CPU and the software.

Format	BMOV(D), (S), (n)

Number of basic steps	6

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(D)	○	○	—	—	—	—	○	—	—	—	—
(S)	○	○	—	—	—	—	○	—	—	—	—
(n)	—	○	—	—	—	○	—	—	—	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(D)	Transfer destination device starting No.	—
(S)	Transfer source device starting No.	
(n)	Number of words to be transferred	

[Functions]

(1) The contents for n words from device specified with (S) are batch-transferred to the n words from device specified with (D).

(2) Data can be transferred if the word devices of the transfer source and destination overlap.
Data are transferred from devices, starting with the one at (S), for transfer of data from devices of larger numbers to those of smaller numbers, or starting with the one at (S)+(n-1) for transfer of data from devices of smaller numbers to those of larger numbers.

(3) Specifying Nn (cam No.) at (D) or (S) enables batch-transfer of cam data.
In the Motion controller, the cam data of same cam No. must already have been registered.
The number of transferred words specified with (n) should match the resolution of the specified cam No..

At cam data write

The cam data storage area is rewritten.

- Transfer of data to the cam data area is also executed during cam operation. Be careful not to perform write while operation is being performed with the same cam No..

At cam data read

The cam data storage area is rewritten.

- The cam data in the currently set status are read.

(4) The word devices that may be set at (D), (S) and (n) are shown below.

Setting data	Word devices (Note-2)			Bit devices (Note-2), (Note-3)					Cam No. specification
	Dn	Wn	#n	Mn	Bn	Fn	Xn	Yn	Nn (Note-1)
(D)	○	○	○	○ (Note-5)	○	○	○ (Note-4)	○ (Note-4)	○
(S)	○	○	○	○	○	○	○ (Note-4)	○ (Note-4)	○
(n)	○	○	○	—	—	—	—	—	—

(Note-1) : "Nn" indicates the cam No..

(Note-2) : The device No. cannot be specified indirectly.

(Note-3) : Specify a multiple of 16 as the device number of bit data.

(Note-4) : PX/PY cannot be set.

(Note-5) : Special relays (M9000 to M9255) and dedicated devices (M2000 to M2399) cannot be set.
(Note: DOUT cannot output the PX, special relays (M2000 to M9255) and dedicted devices (M2000 to M2127).)

(5) The cam No. that may be set as "Nn" is within the following range.

Q173CPU(N)/Q172CPU(N)
1 to 64
101 to 164
201 to 264
301 to 364

[Errors]

(1) An operation error will occur if:

- The cam data of cam No. specified with (D) or (S) are not yet registered to the Motion controller;
- The resolution of cam No. specified with (D) or (S) differs from the number of transferred words specified with (n);
- (S) to (S)+(n-1) is outside the device range;
- (D) to (D)+(n-1) is outside the device range;
- (n) is 0 or a negative number;
- PX/PY is set in (S) to (S)+(n-1); or
- PX/PY is set in (D) to (D)+(n-1).

} when (n) specified is a word device

(2) When conversion is made in program editing of the SW6RN-GSV□P, an error will occur if:

- (S) to (S)+(n-1) is outside the device range;
- (D) to (D)+(n-1) is outside the device range;
- (n) is 0 or a negative number;
- PX/PY is set in (S) to (S) + (n-1).
- PX/PY is set in (D) to (D) + (n-1).

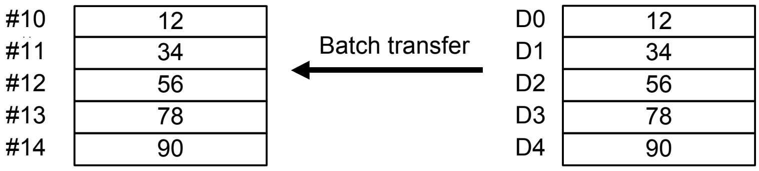
} when (n) specified is a constant

- (S) is a bit device and the device number is not a multiple of 16; or
- (D) is a bit device and the device number is not a multiple of 16.

[Program examples]

(1) Program which batch-transfers a contents for 5 words from D0 to all data for 5 words from #10

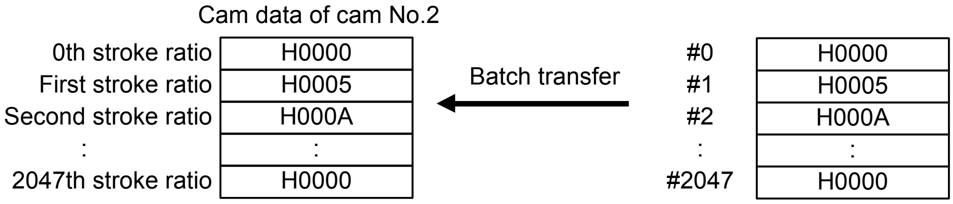
```
BMOV #10, D0, K5
```



#10	12	←	D0	12
#11	34		D1	34
#12	56		D2	56
#13	78		D3	78
#14	90		D4	90

(2) Program which batch-transfers a contents for 2048 words from #0 to the data area of cam No.2 (resolution 2048)

```
BMOV N2, #0, K2048
```



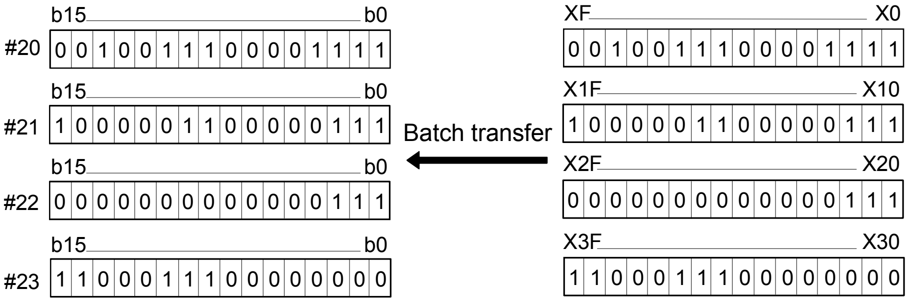
	Cam data of cam No.2			
0th stroke ratio	H0000	←	#0	H0000
First stroke ratio	H0005		#1	H0005
Second stroke ratio	H000A		#2	H000A
:	:		:	:
2047th stroke ratio	H0000		#2047	H0000

POINT

Cam stroke ratio is set within 0 to 7FFFH.

(3) Program which batch-transfers a contents for 4 words from X0 to all data for 4 words from #20

```
BMOV #20, X0, K4
```



	b15 ... b0		X(high) ... X(low)
#20	0 0 1 0 0 1 1 1 0 0 0 0 1 1 1 1	XF ... X0	0 0 1 0 0 1 1 1 0 0 0 0 1 1 1 1
#21	1 0 0 0 0 0 1 1 0 0 0 0 0 1 1 1	X1F ... X10	1 0 0 0 0 0 1 1 0 0 0 0 0 1 1 1
#22	0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1	X2F ... X20	0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1
#23	1 1 0 0 0 1 1 1 0 0 0 0 0 0 0 0	X3F ... X30	1 1 0 0 0 1 1 1 0 0 0 0 0 0 0 0

F/FS	G
○	○

7.13.5 Same data block transfer : FMOV

Refer to the Section "1.3.4" for the correspondence version of the Motion CPU and the software.

Format	FMOV(D), (S), (n)

Number of basic steps	6

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(D)	○	○	—	—	—	—	○	—	—	—	—
(S)	○	○	—	—	—	○	—	—	—	—	—
(n)	—	○	—	—	—	○	—	—	—	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(D)	Transfer destination device starting No.	—
(S)	Device No. which transfer data or data to be transferred are stored.	
(n)	Number of words to be transferred	

[Functions]

(1) The data specified with (S) or contents of word device are transferred a part for (n)words of data to the word device specified with (D).

(2) The word devices that may be set at (D), (S) and (n) are shown below.

Setting data	Word devices(Note-1)			Bit devices(Note-1), (Note-2)				
	Dn	Wn	#n	Mn	Bn	Fn	Xn	Yn
(D)	○	○	○	○ (Note-4)	○	○	○ (Note-3)	○ (Note-3)
(S)	○	○	○	○	○	○	○ (Note-3)	○ (Note-3)
(n)	○	○	○	—	—	—	—	—

(Note-1) : The device No. cannot be specified indirectly.

(Note-2) : Specify a multiple of 16 as the device number of bit data.

(Note-3) : PX/PY cannot be set.

(Note-4) : Special relays (M9000 to M9255) and dedicated devices (M2000 to M2399) cannot be set.

[Errors]

(1) An operation error will occur if:

- (D) to (D)+(n-1) is outside the device range;
- (n) is 0 or a negative number; or
- PX/PY is set in (D) to (D)+(n-1).

} When (n) specified is a word device

(2) When conversion is made in program editing of the SW6RN-GSV□P, an error will occur if:

- (D) to (D)+(n-1) is outside the device range;
- (S) is outside the device range;
- (n) is 0 or a negative number;
- PX/PY is set in (S);
- PX/PY is set in (D) to (D)+(n-1);

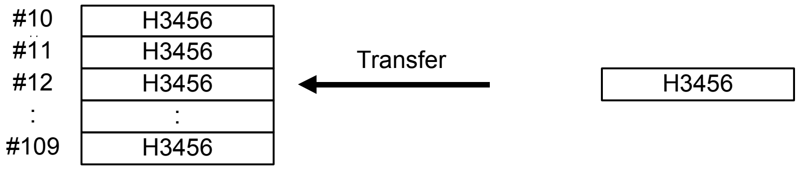
} When (n) specified is a constant

- (S) is a bit device and the device number is not a multiple of 16; or
- (D) is a bit device and the device number is not a multiple of 16.

[Program examples]

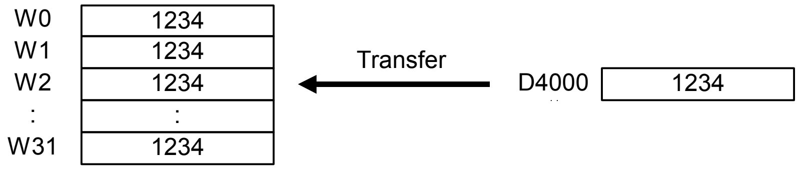
(1) Program which sets 3456H to all data for 100 words from #10

```
FMOV #10, H3456, K100
```



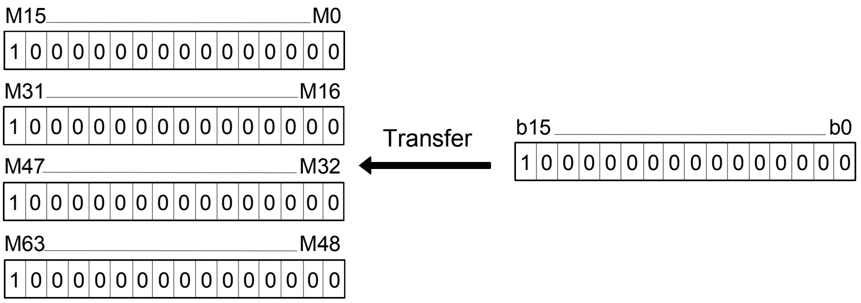
(2) Program which sets a content of D4000 to all data for 50 words from W0

```
FMOV W0, D4000, K50
```



(3) Program which sets 8000H to all data for 4 words from M0

```
FMOV M0, H8000, K4
```



F/FS	G
○	○

7.13.6 Write device data to shared CPU memory of the self CPU: MULTW

Refer to the Section "1.3.4" for the correspondence version of the Motion CPU and the software.

Format	MULTW(D), (S), (n), (D1)	Number of basic steps	8

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(D)	—	○	—	—	—	○	—	—	—	—	—
(S)	○	○	—	—	—	—	—	—	—	—	—
(n)	—	○	—	—	—	○	—	—	—	—	—
(D1)	○	—	—	—	—	—	—	—	—	—	—

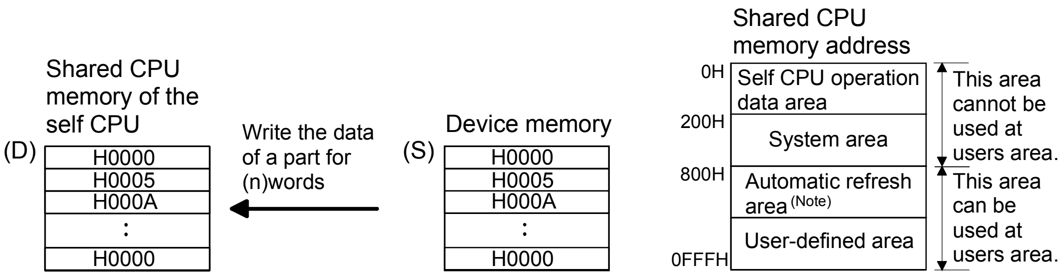
○ : Usable

[Setting data]

Setting data	Description	Data type of result
(D)	The shared CPU memory address of self CPU of the writing destination device. (800H to FFFH)	—
(S)	First device No. which writing data are stored.	
(n)	Number of words to be written (1 to 256)	
(D1)	Self CPU device is made to turn on by the writing completion.	

[Functions]

(1) A part for (n)words of data since the device specified with (S) of the self CPU module are written to since the shared CPU memory address specified with (D) of the self CPU module. After writing completion of the device data, the complete bit device specified with (D1) turns on.


Shared CPU memory of the self CPU
(D)
H0000
H0005
H000A
:
H0000
Write the data of a part for (n)words
Device memory
(S)
H0000
H0005
H000A
:
H0000
Shared CPU memory address
0H
Self CPU operation data area
200H
System area
800H
Automatic refresh area (Note)
0FFFH
User-defined area
This area cannot be used at users area.
This area can be used at users area.

(Note) : When automatic refresh is not set, it can be used as a user defined area. And, when automatic refresh is set up, since the automatic refresh transmitting range becomes a user defined area.

(2) Do resetting of the complete bit device by the user program.

(3) Another MULTW instruction cannot be processed until MULTW instruction is executed and a complete bit device is turned on. When MULTW instruction was executed again before MULTW instruction is executed and complete bit device is turned on, the MULTW instruction executed later becomes an error.

(4) The word devices that may be set at (D), (S) (n) and (D1) are shown below.

Setting data	Word devices (Note-1)			Bit devices (Note-1), (Note-2)				
	Dn	Wn	#n	Mn	Bn	Fn	Xn	Yn
(D)	○	○	○	—	—	—	—	—
(S)	○	○	○	○	○	○	○ (Note-3)	○ (Note-3)
(n)	○	○	○	—	—	—	—	—
(D1)	—	—	—	○	○	○	○ (Note-4)	○ (Note-4)

(Note-1) : The device No. cannot be specified indirectly.
(Note-2) : Specify a multiple of 16 as the device number of bit data.
(Note-3) : PX/PY cannot be set.
(Note-4) : PY can be set. PX cannot be set.

(5) Adjust an executive task, the number of transfer word referring to the operation processing time so that this instruction may not obstruct the execution of the motion operation because processing time becomes long in argument to the number of words (n) to be written.

[Errors]

(1) An operation error will occur if:

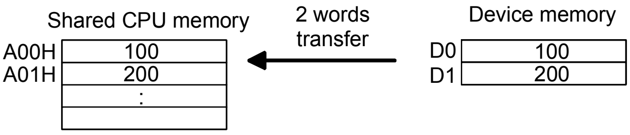
- Number of words (n) to be written is outside the range of 1 to 256.
- The shared CPU memory address (D) of self CPU of the writing destination device is outside the range (800H to FFFH) of the shared CPU memory address.
- The shared CPU memory address (D) of self CPU of the writing destination device + number of words (n) to be written is outside the range (800H to FFFH) of the shared CPU memory address.
- First device No. (S) which writing data are stored + number of words (n) to be written is outside the device range.
- MULTW instruction was executed again before MULTW instruction is executed and complete bit device is turned on.
- (D1) is a write-disabled device.
- (S) is a bit device and device number is not a multiple of 16.
- PX/PY is set in (S) to (S)+(n-1).

[Program examples]

(1) 2 words from D0 is written in the shared CPU memory to since A00H, and transits to next step after confirmation of writing completion.

```
F0
    RST M0
    MULTW  HA00, D0, K2, M0

G0
    M0
```



F/FS	G
○	○

7.13.7 Read device data from shared CPU memory of the other CPU: MULTR

Refer to the Section "1.3.4" for the correspondence version of the Motion CPU and the software.

Format	MULTR(D), (S1), (S2), (n)

Number of basic steps	7

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(D)	○	○	—	—	—	—	—	—	—	—	—
(S1)	—	○	—	—	—	○	—	—	—	—	—
(S2)	—	○	—	—	—	○	—	—	—	—	—
(n)	—	○	—	—	—	○	—	—	—	—	—

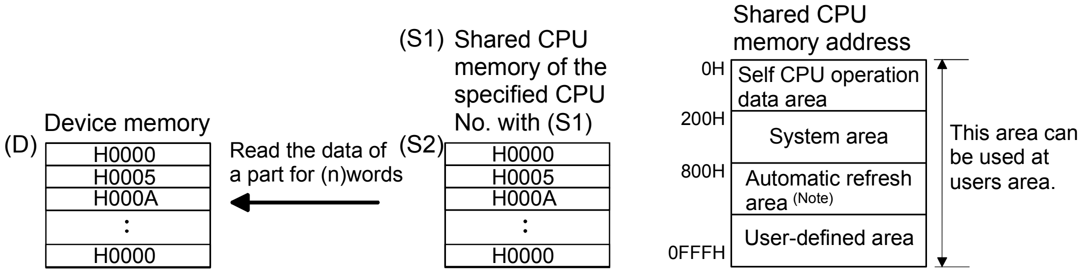
○ : Usable

[Setting data]

Setting data	Description	Data type of result
(D)	First device No. which stores the reading data.	—
(S1)	First I/O No. of the PLC CPU/Motion CPU which it will be read. (CPU No.1 : 3E0H, CPU No.2 : 3E1H, CPU No.3 : 3E2H, CPU No.4 : 3E3H)	
(S2)	The shared CPU memory first address of the data which it will be read. (000H to FFFH)	
(n)	Number of words to be read (1 to 256)	

[Functions]

(1) A part for (n)words of data of the other CPU specified with (S1) are read from the address specified with (S2) of the shared CPU memory, and are stored since the device specified with (S2).


(D)
Device memory
H0000
H0005
H000A
:
H0000
Read the data of a part for (n)words
(S1) Shared CPU memory of the specified CPU No. with (S1)
(S2)
H0000
H0005
H000A
:
H0000
Shared CPU memory address
0H
200H
800H
0FFFH
Self CPU operation data area
System area
Automatic refresh area (Note)
User-defined area
This area can be used at users area.

(Note) : When automatic refresh is not set, it can be used as a user defined area. And, when automatic refresh is set up, since the automatic refresh transmitting range becomes a user defined area.

(2) The word devices that may be set at (D), (S), (n) and (D1) are shown below.

Setting data	Word devices (Note-1)			Bit devices (Note-1), (Note-2)				
	Dn	Wn	#n	Mn	Bn	Fn	Xn	Yn
(D)	○	○	○	○ (Note-3)	○	○	○ (Note-4)	○ (Note-4)
(S)	○	○	○	—	—	—	—	—
(n)	○	○	○	—	—	—	—	—
(D1)	○	○	○	—	—	—	—	—

(Note-1) : The device No. cannot be specified indirectly.

(Note-2) : Specify a multiple of 16 as the device number of bit data.

(Note-3) : Special relays (M9000 to M9255) and dedicated devices (M2000 to M2399) cannot be set.

(Note-4) : PX/PY cannot be set.

(3) When data are read normally from the target CPU specified with (S1), the reading complete flag M9216 to M9219 (CPU No.1 : M9216, CPU No.2 : M9217, CPU No.3 : M9218, CPU No.4 : M9219) corresponding to the target CPU turns on. If data cannot be read normally, the reading complete flag of the target CPU does not turn on.

(4) Adjust an executive task, the number of transfer word referring to the operation processing time so that this instruction may not obstruct the execution of the motion operation because processing time becomes long in argument to the number of words (n) to be written.

(5) When multiple MULTR instructions are executed to the same CPU simultaneously, the reading complete flag M9216 to M9219 turns on/as a result of MULTR that it is executed at the end.

(6) Reset the reading complete flag (M9126 to M9219) using the user program.

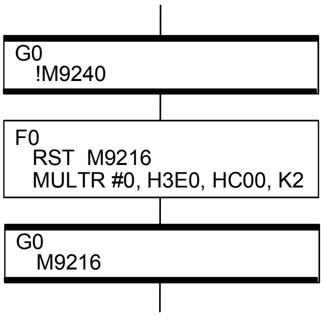
[Errors]

(1) An operation error will occur if:

- Number of words (n) to be read is outside the range of 1 to 256.
- The shared CPU memory first address (S2) of the data which it will be read is outside the range (000H to FFFH) of the shared CPU memory address.
- The shared CPU memory first address (S2) of the data which it will be read + number of words (n) to be read is outside the range (000H to FFFH) of the shared CPU memory address.
- First device No. (D) which stores the reading data + number of words (n) to be read is outside the device range.
- Except 3E0H/3E1H/3E2H/3E3H is set at (S1).
- The self CPU is specified with (S1).
- The CPU which reads is resetting.
- The errors are detected in the CPU which read.
- (D) is a bit device and device number is not a multiple of 16.
- PX/PY is set in (D) to (D)+(n-1).

[Program examples]

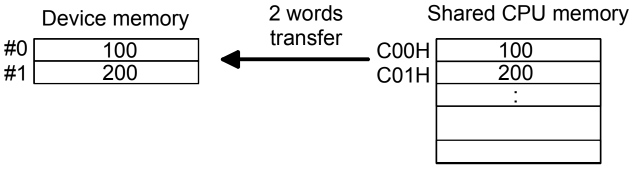
(1) It checks that a CPU No.1 is not resetting, 2 words is read to since #0 from the shared CPU memory C00H of CPU No.1, and transits to next step after reading completion.



```
G0
  !M9240

F0
  RST  M9216
  MULTR #0, H3E0, HC00, K2

G0
  M9216
```



Device memory

#0	100
#1	200

Shared CPU memory

C00H	100
C01H	200
	:

F/FS	G
○	○

7.13.8 Write device data to intelligent function module/special function module : TO

Refer to the Section "1.3.4" for the correspondence version of the Motion CPU and the software.

Format	TO(D1), (D2), (S), (n)

Number of basic steps	7

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(D1)	—	○	—	—	—	○	—	—	—	—	—
(D2)	—	○	—	—	—	○	—	—	—	—	—
(S)	○	○	—	—	—	—	—	—	—	—	—
(n)	—	○	—	—	—	○	—	—	—	—	—

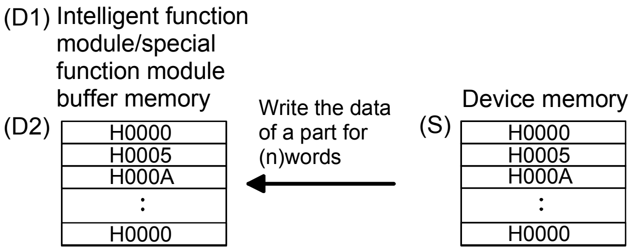
○ : Usable

[Setting data]

Setting data	Description	Data type of result
(D1)	First I/O No. of the intelligent function module / special function module(000H to FF0H)	—
(D2)	First address of the buffer memory which writes data.	
(S)	First device No. which writing data are stored.	
(n)	Number of words to be written (1 to 256)	

[Functions]

(1) A part for (n)words of data from device specified with (S) are written to since address specified with (D2) of the buffer memory in the intelligent function module/special function module controlled by the self CPU specified with (D1).


(D1) Intelligent function module/special function module buffer memory
(D2)
H0000
H0005
H000A
:
H0000
Write the data of a part for (n)words
(S)
Device memory
H0000
H0005
H000A
:
H0000

(2) First I/O No. of the module set by system setting is specified by (D1).

Power supply module	Q02H CPU	Q173 CPU(N)	QX40 First I/O No. No. : 00H	Q64AD First I/O No. No. : 10H	Q64DA First I/O No. No. : 20H	

(D1) sets 20H by the system setting when a TO instruction is executed in the D/A conversion module (Q64DA).

(3) The word devices that may be set at (D1), (D2), (S) and (n) are shown below.

Setting data	Word devices (Note-1)			Bit devices (Note-1), (Note-2)				
	Dn	Wn	#n	Mn	Bn	Fn	Xn	Yn
(D1)	○	○	○	—	—	—	—	—
(D2)	○	○	○	—	—	—	—	—
(S)	○	○	○	○	○	○	○ (Note-3)	○ (Note-3)
(n)	○	○	○	—	—	—	—	—

(Note-1) : The device No. cannot be specified indirectly.
(Note-2) : Specify a multiple of 16 as the device number of bit data.
(Note-3) : PX/PY cannot be set.

(4) Adjust an executive task, the number of transfer word referring to the operation processing time so that this instruction may not obstruct the execution of the motion operation because processing time becomes long in argument to the number of words (n) to be written.

(5) The following analogue modules can be used as the control module of Motion CPU.

- Q62DA
- Q64DA
- Q68DAV
- Q68DAI
- Q64AD
- Q68ADV
- Q68ADI

[Errors]

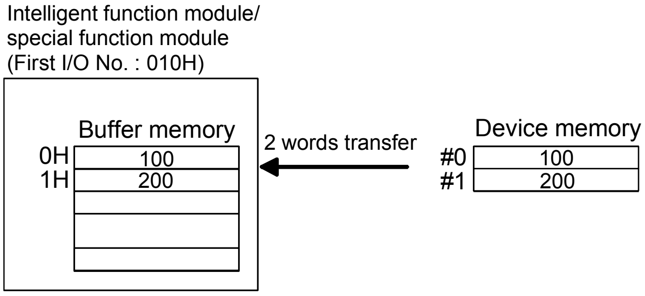
(1) An operation error will occur if:

- Number of words (n) to be written is outside the range of 1 to 256.
- Motion CPU cannot communicate with intelligent function module/special function module at the instruction execution.
- Abnormalities of the intelligent function module/special function module were detected at the instruction execution.
- I/O No.s specified with (D1) differ from the intelligent function module/special function module controlled by the self CPU.
- The address specified with (D2) is outside the buffer memory range.
- First device No. (S) which writing data are stored + number of words (n) to be written is outside the device range.
- (S) is a bit device and device number is not a multiple of 16.
- PX/PY is set in (S) to (S)+(n-1).

[Program examples]

(1) 2 words from #0 is written to since buffer memory address of the Intelligent function module/special function module (First I/O No. : 010H).

```
TO H010, H0, #0, K2
```



F/FS	G
○	○

7.13.9 Read device data from intelligent function module/special function module : FROM

Refer to the Section "1.3.4" for the correspondence version of the Motion CPU and the software.

Format	FROM(D), (S1), (S2), (n)

Number of basic steps	7

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(D)	○	○	—	—	—	—	—	—	—	—	—
(S1)	—	○	—	—	—	○	—	—	—	—	—
(S2)	—	○	—	—	—	○	—	—	—	—	—
(n)	—	○	—	—	—	○	—	—	—	—	—

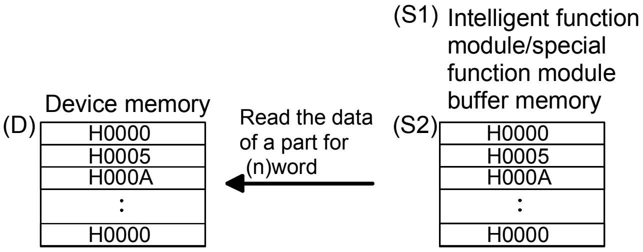
○ : Usable

[Setting data]

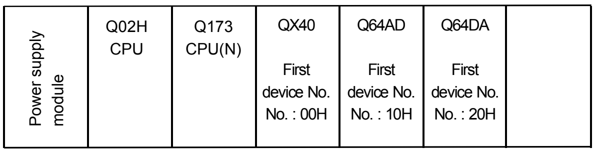
Setting data	Description	Data type of result
(D)	First device No. which stores the reading data.	—
(S1)	First I/O No. of the intelligent function module / special function module (000H to FF0H)	
(S2)	First address of the buffer memory which it will be read.	
(n)	Number of words to be read (1 to 256)	

[Functions]

(1) A part for (n)words of data are read from the address specified with (S2) of the buffer memory in the intelligent function module/special function module controlled by the self CPU specified with (S1), and are stored since the device specified with (S2).


(S1) Intelligent function module/special function module buffer memory
Device memory
(D)
H0000
H0005
H000A
:
H0000
Read the data of a part for (n)word
(S2)
H0000
H0005
H000A
:
H0000

(2) First I/O No. of the module set by system setting is specified by (D1).


Power supply module
Q02H CPU
Q173 CPU(N)
QX40 First device No. No. : 00H
Q64AD First device No. No. : 10H
Q64DA First device No. No. : 20H

(D1) sets 20H by the system setting when a TO instruction is executed in the D/A conversion module (Q64DA).

(3) The word devices that may be set at (D), (S1), (S2) and (n) are shown below.

Setting data	Word devices (Note-1)			Bit devices (Note-1), (Note-2)				
	Dn	Wn	#n	Mn	Bn	Fn	Xn	Yn
(D)	○	○	○	○ (Note-3)	○	○	○ (Note-4)	○ (Note-4)
(S1)	○	○	○	—	—	—	—	—
(S2)	○	○	○	—	—	—	—	—
(n)	○	○	○	—	—	—	—	—

(Note-1) : The device No. cannot be specified indirectly.

(Note-2) : Specify a multiple of 16 as the device number of bit data.

(Note-3) : Special relays (M9000 to M9255) and dedicated devices (M2000 to M2399) cannot be set.

(Note-4) : PX/PY cannot be set.

(4) Adjust an executive task, the number of transfer word referring to the operation processing time so that this instruction may not obstruct the execution of the motion operation because processing time becomes long in argument to the Number of words (n) to be read.

(5) The following analogue modules can be used as the control module of Motion CPU.

- Q62DA
- Q64DA
- Q68DAV
- Q68DAI
- Q64AD
- Q68ADV
- Q68ADI

[Errors]

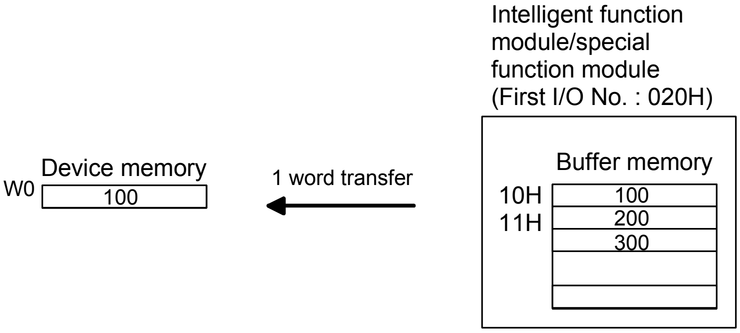
(1) An operation error will occur if:

- Number of words (n) to be read is outside the range of 1 to 256.
- Motion CPU cannot communicate with intelligent function module/special function module at the instruction execution.
- Abnormalities of the intelligent function module/special function module were detected at the instruction execution.
- I/O No.s specified with (S1) differ from the intelligent function module/special function module controlled by the self CPU.
- The address specified with (S2) is outside the buffer memory range.
- First device No. (D) which stores the reading data + number of words (n) to be read is outside the device range.
- (D) is a bit device and device number is not a multiple of 16.
- PX/PY is set in (D) to (D) + (n-1).

[Program examples]

(1) 1 word is read from the buffer memory address 10H of the intelligent function module/special function module (First I/O No. : 020H), and is stored in W0.

```
FROM W0, H020, H10, K1
```


Intelligent function module/special function module (First I/O No. : 020H)
Buffer memory
10H
11H
100
200
300
1 word transfer
Device memory
W0
100

F/FS	G
—	○

7.13.10 Time to wait : TIME

Format	TIME(S)

Number of basic steps	7

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
(S)	—	○	○	—	—	○	○	—	—	—	—

○ : Usable

[Setting data]

Setting data	Description	Data type of result
(S)	Waiting time (0 to 2147483647)ms	Logical type (true/false)

[Functions]

(1) A wait state continues for the time specified with (S). The result is false when the elapsed time is less than the preset time, or the result is true and execution transits when the preset time has elapsed.

(2) When a 16-bit integer type word device is used to specify any of 32768 to 65535ms at (S), convert it into an unsigned 16-bit integer value with USHORT. (Refer to the program example.)

[Errors]

(1) An operation error will occur if:

- (S) is an indirectly specified device and its device No. is outside the range. ; or
- The data (device data at indirect specification) specified with (S) is outside the range of 0 to 2147483647.

[Program examples]

(1) Program which sets a wait of 60 seconds (when constant is specified)

```
TIME K60000
```

(2) Program for a case where there may be a wait of 32768 to 65535ms for 16-bit integer type indirect designation (#0)

```
TIME USHORT(#0)
```

(3) Program which SETS (RSTs) a bit device when the specified time has elapsed

```
SET M100 = TIME K60000
```

POINT

(1) When the waiting time setting is indirectly specified with a word device, the value imported first is used as the device value for exercising control. The set time cannot be changed if the device value is changed during a wait state.
(2) The TIME instruction is equivalent to a conditional expression, and therefore may be set on only the last line of a transition (G) program.
(3) When the transition program (Gn) of the same number having the TIME instruction setting is used in multiple Motion SFC programs, avoid running them at the same time. (If they are run simultaneously, the waiting time in the program run first will be illegal.)
(4) Another transition program (Gn) can executed a time of instruction by multiple Motion SFC program simultaneously. (Multi active step less than 256.)
(5) While time by TIME instruction waits, the wait time can not be stopped.
(6) When using the TIME instruction, a verification error may occur, even when the Motion SFC program of SW6RN-GSV□P is equal to the Motion CPU, if a verification of Motion SFC program is executed.

F/FS	G
○	○

7.14 Comment Statement : //

Format	//

Number of basic steps	—

[Usable data]

Setting data	Usable Data										
	Bit device	Word device				Constant			Calculation expression	Bit conditional expression	Comparison conditional expression
		16-bit integer type	32-bit integer type (L)	64-bit floating point type (F)	Coasting timer	16-bit integer type (K/H)	32-bit integer type (K/H, L)	64-bit floating point type (K)			
—	—	—	—	—	—	—	—	—	—	—	—

○ : Usable

[Setting data]

There are no setting data.

[Functions]

(1) A character string from after // to a block end is a comment.

[Errors]

(1) There are no operation errors for comment: //.

[Program examples]

(1) Example which has commented a substitution program.

```
D0=D1//Substitutes the D0 value (16-bit integer data) to D1.
```

8. TRANSITION PROGRAMS

8.1 Transition Programs

(1) Transition programs

(a) Substitution operation expressions, motion-dedicated functions, bit device control commands and transition conditions can be set in transition programs.

(b) Multiple blocks can be set in one transition program.

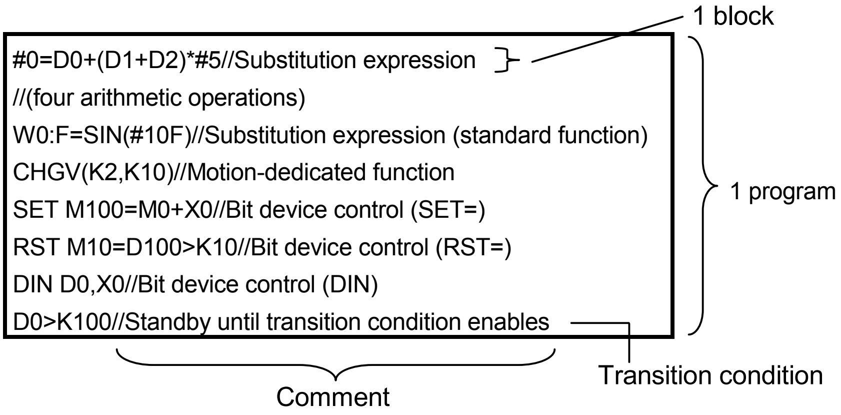
(c) There are no restrictions on the number of blocks that may be set in a single transition program.
Note that one program is within 64k bytes.

(d) The maximum number of characters in one block is 128.

(e) Transition condition must be set in the last block of a transition program.
Transition program is repeated until the transition condition enables, and when the transition condition has enabled, it shifts to the next step.
Transition condition can be set only in the last block.

(f) As a special transition program, a program which only no operation (NOP) is set in one block can be created.
This program is used when you want to proceed to the next step on completion of a servo program run and there are no special conditions to be set as interlocks. Refer to Section "6.9 Branches, Couplings" for details.

A transition program example is shown below.



```
#0=D0+(D1+D2)*#5//Substitution expression
//(four arithmetic operations)
W0:F=SIN(#10F)//Substitution expression (standard function)
CHGV(K2,K10)//Motion-dedicated function
SET M100=M0+X0//Bit device control (SET=)
RST M10=D100>K10//Bit device control (RST=)
DIN D0,X0//Bit device control (DIN)
D0>K100//Standby until transition condition enables
```

What can be set as a transition condition in the last block are bit conditional expressions, comparison conditional expressions and device set (SET=)/device reset (RST=) which return logical data values (true/false). In the case of device set (SET=)/device reset (RST=), whether the bit or comparison conditional expression specified at (S) is true or false is a transition condition, and when the transition condition enables, device set/reset is executed and execution shifts to the next step.

Transition condition description examples are given below.

Classification	Description example
Bit conditional expression	M0
	!M0+X10*M100
Comparison conditional expression	(D0>K100)+(D100L!=K20L)
Device set (SET=)	SET Y0=M100
Device reset (RST=)	RST M10=D0==K100

POINT

(1) A transition program differs from an operation control program in that a transition condition is set in the last block.
Other settings are the same as those of the operation control program.

(2) When setting device set (SET=)/device reset (RST=) in the last block as a transition condition, the bit or comparison conditional expression specified with (S) is not omissible.

(3) Only the bit or comparison conditional expression cannot be set in other than the last block. Device set (SET=)/device reset (RST=) can be set in other than the last block.

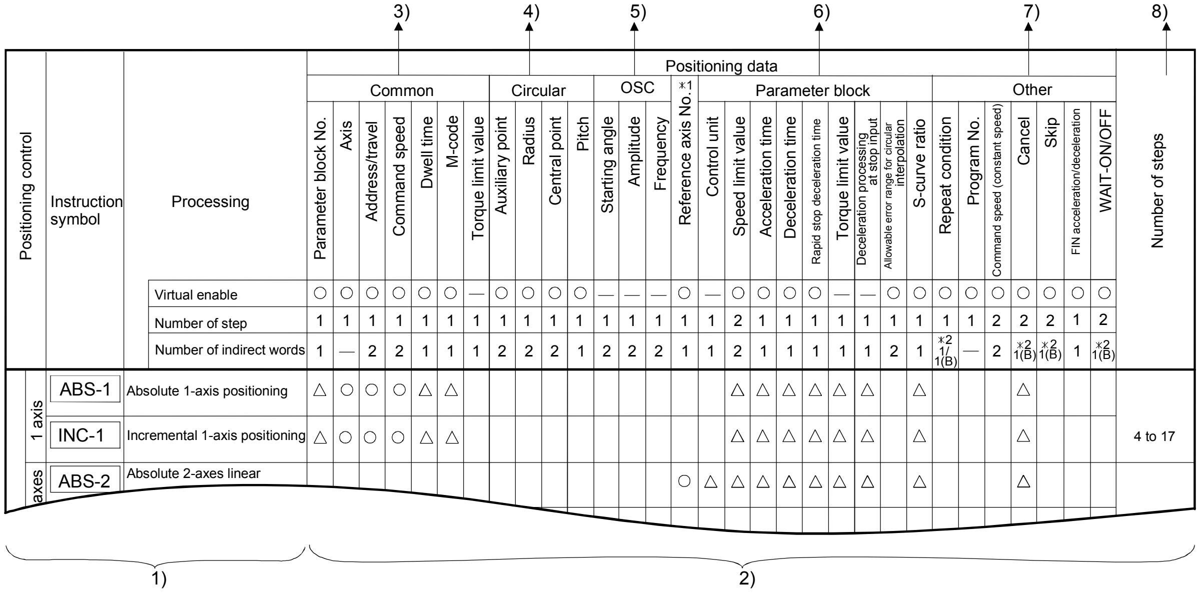
9. MOTION CONTROL PROGRAMS

9.1 Servo Instruction List

Table 9.1 lists servo instructions used in servo programs.
Refer to Section 9.2 to 9.4 for details of the current value change control (CHGA, CHGA-E, CHGA-C).
Refer to the "Q173CPU(N)/Q172CPU(N) Motion Controller (SV13/SV22) Programming Manual (REAL MODE)" for other servo instructions.

(1) Guide to servo instruction list

Table 9.1 Guide to Servo Instruction List



Positioning control	Instruction symbol	Processing	Positioning data																															Number of steps
			Common							Circular				OSC			*1	Parameter block									Other							
			Parameter block No.	Axis	Address/travel	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Pitch	Starting angle	Amplitude	Frequency	Reference axis No.	Control unit	Speed limit value	Acceleration time	Deceleration time	Rapid stop deceleration time	Torque limit value	Deceleration processing at stop input	Allowable error range for circular interpolation	S-curve ratio	Repeat condition	Program No.	Command speed (constant speed)	Cancel	Skip	FIN acceleration/deceleration	WAIT-ON/OFF	
		Virtual enable	○	○	○	○	○	○	—	○	○	○	○	—	—	—	○	—	○	○	○	○	—	—	○	○	○	○	○	○	○	○	○	
		Number of step	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	2	2	2	1	2	
		Number of indirect words	1	—	2	2	1	1	1	2	2	2	1	2	2	2	1	1	2	1	1	1	1	1	2	1	*2 1/ 1(B)	—	2	*2 1(B)	*2 1(B)	1	*2 1(B)	
1 axis	ABS-1	Absolute 1-axis positioning	△	○	○	○	△	△											△	△	△	△	△	△		△				△				4 to 17
	INC-1	Incremental 1-axis positioning	△	○	○	○	△	△											△	△	△	△	△	△		△				△				
axes	ABS-2	Absolute 2-axes linear															○	△	△	△	△	△	△	△		△				△				

Number	Description	
1)	Instruction symbol	Gives the servo instructions usable in servo programs.
	Processing	Gives the processing outlines of the servo instructions.
2)	(a) Indicates positioning data which can be set in servo instructions. 1) ○: Item which must be set (Data which cannot execute the servo instruction unless it sets.) 2) △: Item which is set when required (Data which will be controlled by the default value unless it sets.)	
	(b) Allows direct or indirect designation (except axis No.) 1) Direct designation : Set with numerical value. 2) Indirect designation : Set with word device (D, W, #). • Servo program execution is controlled using the preset word device contents. • Each setting item may either be 1 or 2 word data. • For 2 word data, set the first device No..	
	(c) Number of steps As there are more setting items, there are more number of instruction steps. (The number of steps is displayed when a servo program is created.) (The instruction + ○ item comprise the minimum steps, and one △ item increases the number of steps by 1.)	
3)	Items common to the servo instructions	
4)	Items set in circular interpolation starting servo programs	
5)	Items set for high-speed oscillation	
6)	Set when changing the parameter block (default value when not set) data set in the servo program to control. (The parameter block data are not changed.)	
7)	Setting items other than the common, circular and parameter block items (Items to be set vary with the servo instruction.)	
8)	Indicates the number of steps of each servo instruction.	

(2) Servo instruction list

Table 9.2 indicates the servo instructions available for servo programs and the positioning data set in servo instructions.

Table 9.2 Servo Instruction List

Positioning control		Instruction symbol	Processing	Positioning data										
				Common							Circular			
				Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M -code	Torque limit value	Auxiliary point	Radius	Central point	Pitch
			Virtual enable	○	○	○	○	○	○	—	○	○	○	○
			Number of steps	1	1	1	1	1	1	1	1	1	1	1
			Number of indirect words	1	—	2	2	1	1	1	2	2	2	1
Linear interpolation control	1 axis	ABS-1	Absolute 1-axis positioning	△	○	○	○	△	△					
		INC-1	Incremental 1-axis positioning	△	○	○	○	△	△					
	2 axes	ABS-2	Absolute 2-axes linear interpolation	△	○	○	○	△	△					
		INC-2	Incremental 2-sxes linear interpolation	△	○	○	○	△	△					
	3 axes	ABS-3	Absolute 3-axes linear interpolation	△	○	○	○	△	△					
		INC-3	Incremental 3-axes linear interpolation	△	○	○	○	△	△					
	4 axes	ABS-4	Absolute 4-axes linear interpolation	△	○	○	○	△	△					
		INC-4	Incremental 4-axes linear interpolation	△	○	○	○	△	△					
Circular interpolation control	Auxiliary point-specified	ABS⌒	Absolute auxiliary point-specified circular interpolation	△	○	○	○	△	△		○			
		INC ⌒	Incremental auxiliary point-specified circular interpolation	△	○	○	○	△	△		○			
	Radius-specified	ABS↷	Absolute radius-specified circular interpolation less than CW 180°	△	○	○	○	△	△			○		
		ABS⟳	Absolute radius-specified circular interpolation CW 180° or more	△	○	○	○	△	△			○		
		ABS↶	Absolute radius-specified circular interpolation less than CCW 180°	△	○	○	○	△	△			○		
		ABS⟲	Absolute radius-specified circular interpolation CCW 180° or more	△	○	○	○	△	△			○		
		INC ↷	Incremental radius-specified circular interpolation less than CW 180°	△	○	○	○	△	△			○		
		INC ⟳	Incremental radius-specified circular interpolation CW 180° or more	△	○	○	○	△	△			○		
		INC ↶	Incremental radius-specified circular interpolation less than CCW 180°	△	○	○	○	△	△			○		
		INC ⟲	Incremental radius-specified circular interpolation CCW 180° or more	△	○	○	○	△	△			○		

Positioning data																						Number of steps
OSC			*1	Parameter block									Others									
Starting angle	Amplitude	Frequency	Reference axis No.	Control unit	Speed limit value	Acceleration time	Deceleration time	Rapid stop deceleration time	Torque limit value	Deceleration processing at stop input	Allowable error range for circular interpolation	S-curve ratio	Repeat condition	Program No.	Command speed (constant speed)	Cancel	Skip	FIN acceleration/deceleration	WAIT-ON/OFF			
—	—	—	○	—	○	○	○	○	—	—	○	○	○	○	○	○	○	○	○			
1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	2	2	2	1	2			
2	2	2	1	1	2	1	1	1	1	1	2	1	*2 1/ 1(B)	—	2	*2 1(B)	*2 1(B)	1	*2 1(B)			
					△	△	△	△	△	△		△				△						4 to 17
					△	△	△	△	△	△		△				△						
			○	△	△	△	△	△	△	△		△				△						5 to 20
			○	△	△	△	△	△	△	△		△				△						
			○	△	△	△	△	△	△	△		△				△						7 to 21
			○	△	△	△	△	△	△	△		△				△						
			○	△	△	△	△	△	△	△		△				△						8 to 22
			○	△	△	△	△	△	△	△		△				△						
				△	△	△	△	△	△	△	△	△				△						7 to 22
				△	△	△	△	△	△	△	△	△				△						
				△	△	△	△	△	△	△	△	△				△						6 to 21
				△	△	△	△	△	△	△	△	△				△						
				△	△	△	△	△	△	△	△	△				△						
				△	△	△	△	△	△	△	△	△				△						
				△	△	△	△	△	△	△	△	△				△						
				△	△	△	△	△	△	△	△	△				△						
				△	△	△	△	△	△	△	△	△				△						
				△	△	△	△	△	△	△	△	△				△						

○ : Must be set. △ : Set if required.
*1 : Only reference axis speed specification.
*2 : (B) indicates a bit device.

Table 9.2 Servo Instruction List (continued)

Positioning control		Instruction symbol	Processing	Positioning data										
				Common							Circular			
				Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Pitch
			Virtual enable	○	○	○	○	○	○	—	○	○	○	○
			Number of steps	1	1	1	1	1	1	1	1	1	1	1
			Number of indirect words	1	—	2	2	1	1	1	2	2	2	1
Circular interpolation control	Central point-specified	ABS ↷	Absolute central point-specified circular interpolation CW	△	○	○	○	△	△				○	
		ABS ↶	Absolute central point-specified circular interpolation CCW	△	○	○	○	△	△				○	
		INC ↷	Incremental central point-specified circular interpolation CW	△	○	○	○	△	△				○	
		INC ↶	Incremental central point-specified circular interpolation CCW	△	○	○	○	△	△				○	
Helical interpolation control	Auxiliary point-specified	ABH ⌒	Absolute auxiliary point- specified helical interpolation	△	○	○	○	△	△		○			○
		INH ⌒	Incremental auxiliary point- specified helical interpolation	△	○	○	○	△	△		○			○
	Radius-specified	ABH ↷	Absolute radius-specified helical interpolation less than CW 180°	△	○	○	○	△	△			○		○
		ABH ⟳	Absolute radius-specified helical interpolation CW 180° or more	△	○	○	○	△	△			○		○
		ABH ↶	Absolute radius-specified helical interpolation less than CCW 180°	△	○	○	○	△	△			○		○
		ABH ⟲	Absolute radius-specified helical interpolation CCW 180° or more	△	○	○	○	△	△			○		○
		INH ↷	Incremental radius-specified helical interpolation less than CW 180°	△	○	○	○	△	△			○		○
		INH ⟳	Incremental radius-specified helical interpolation CW 180° or more	△	○	○	○	△	△			○		○
		INH ↶	Incremental radius-specified helical interpolation less than CCW 180°	△	○	○	○	△	△			○		○
		INH ⟲	Incremental radius-specified helical interpolation CCW 180° or more	△	○	○	○	△	△			○		○
	Central point-specified	ABH ↷	Absolute central point-specified helical interpolation CW	△	○	○	○	△	△				○	○
		ABH ↶	Absolute central point-specified helical interpolation CCW	△	○	○	○	△	△				○	○
		INH ↷	Incremental central point-specified helical interpolation CW	△	○	○	○	△	△				○	○
		INH ↶	Incremental central point-specified helical interpolation CCW	△	○	○	○	△	△				○	○

	Positioning data																						Number of steps
	OSC			*1	Parameter block									Others									
	Starting angle	Amplitude	Frequency	Reference axis No.	Control unit	Speed limit value	Acceleration time	Deceleration time	Rapid stop deceleration time	Torque limit value	Deceleration processing at stop input	Allowable error range for circular interpolation	S-curve ratio	Repeat condition	Program No.	Command speed (constant speed)	Cancel	Skip	FIN acceleration/deceleration	WAIT-ON/OFF			
	—	—	—	○	—	○	○	○	○	—	—	○	○	○	○	○	○	○	○	○			
	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	2	2	2	1	2			
	2	2	2	1	1	2	1	1	1	1	1	2	1	*2 1/ 1(B)	—	2	*2 1(B)	*2 1(B)	1	*2 1(B)			
					△	△	△	△	△	△	△	△	△				△						7 to 22
					△	△	△	△	△	△	△	△	△				△						
					△	△	△	△	△	△	△	△	△				△						
					△	△	△	△	△	△	△	△	△				△						
					△	△	△	△	△	△	△		△				△						10 to 27
					△	△	△	△	△	△	△		△				△						
					△	△	△	△	△	△	△		△				△						9 to 26
					△	△	△	△	△	△	△		△				△						
					△	△	△	△	△	△	△		△				△						
					△	△	△	△	△	△	△		△				△						
					△	△	△	△	△	△	△		△				△						
					△	△	△	△	△	△	△		△				△						
					△	△	△	△	△	△	△		△				△						
					△	△	△	△	△	△	△		△				△						
					△	△	△	△	△	△	△		△				△						10 to 27
					△	△	△	△	△	△	△		△				△						
					△	△	△	△	△	△	△		△				△						
					△	△	△	△	△	△	△		△				△						

○ : Must be set. △ : Set if required.
*1 : Only reference axis speed specification.
*2 : (B) indicates a bit device.

Table 9.2 Servo Instruction List (continued)

Positioning control		Instruction symbol	Processing	Positioning data										
				Common							Circular			
				Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Pitch
			Virtual enable	○	○	○	○	○	○	—	○	○	○	○
			Number of steps	1	1	1	1	1	1	1	1	1	1	1
			Number of indirect words	1	—	2	2	1	1	1	2	2	2	1
Fixed-pitch feed	1 axis	FEED-1	1-axis fixed-pitch feed start	△	○	○	○	△	△					
	2 axes	FEED-2	2-axes linear interpolation fixed-pitch feed start	△	○	○	○	△	△					
	3 axes	FEED-3	3-axes linear interpolation fixed-pitch feed start	△	○	○	○	△	△					
Speed control (I)	Forward rotation	VF	Speed control (I) forward rotation start	△	○		○		△					
	Reverse rotation	VR	Speed control (I) reverse rotation start	△	○		○		△					
Speed control (II)	Forward rotation	VVF	Speed control (II) forward rotation start	△	○		○		△	△				
	Reverse rotation	VVR	Speed control (II) reverse rotation start	△	○		○		△	△				
Speed-position control	Forward rotation	VPF	Speed-position control forward rotation start	△	○	○	○	△	△	△				
	Reverse rotation	VPR	Speed-position control reverse rotation start	△	○	○	○	△	△	△				
	Restart	VPSTART	Speed-position control restart		○									
Speed-switching control		VSTART	Speed-switching control start	△										
		VEND	Speed-switching control end											
		ABS-1	Speed-switching control end point address		○	○	○	△	△	△				
		ABS-2			○	○	○	△	△	△				
		ABS-3			○	○	○	△	△	△				
		INC-1	Travel value up to speed-switching control end point		○	○	○	△	△	△				
		INC-2			○	○	○	△	△	△				
		INC-3			○	○	○	△	△	△				
		VABS	Speed-switching point absolute specification			○	○		△	△				
		VINC	Speed-switching point incremental specification			○	○		△	△				

Positioning data																						
OSC			*1	Parameter block									Others									
Starting angle	Amplitude	Frequency	Reference axis No.	Control unit	Speed limit value	Acceleration time	Deceleration time	Rapid stop deceleration time	Torque limit value	Deceleration processing at stop input	Allowable error range for circular interpolation	S-curve ratio	Repeat condition	Program No.	Command speed (constant speed)	Cancel	Skip	FIN acceleration/deceleration	WAIT-ON/OFF			Number of steps
—	—	—	○	—	○	○	○	○	—	—	○	○	○	○	○	○	○	○	○			
1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	2	2	2	1	2			
2	2	2	1	1	2	1	1	1	1	1	2	1	*2 1/ 1(B)	—	2	*2 1(B)	*2 1(B)	1	*2 1(B)			
					△	△	△	△	△	△		△				△						4 to 17
				△	△	△	△	△	△	△		△				△						5 to 19
				△	△	△	△	△	△	△		△				△						7 to 21
					△	△	△	△	△	△		△				△						3 to 15
					△	△	△	△	△	△		△				△						
					△	△	△	△	△	△		△				△						3 to 16
					△	△	△	△	△	△		△				△						
					△	△	△	△	△	△		△				△						4 to 18
					△	△	△	△	△	△		△				△						
																△						2 to 4
				△	△	△	△	△	△	△		△				△						1 to 13
																						1
																△						4 to 9
																△						5 to 10
																△						7 to 12
																△						4 to 9
																△						5 to 10
																△						7 to 12
																						4 to 6

○ : Must be set. △ : Set if required.
*1 : Only reference axis speed specification.
*2 : (B) indicates a bit device.

Table 9.2 Servo Instruction List (continued)

Positioning control	Instruction symbol	Processing	Positioning data										
			Common							Circular			
			Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Pitch
		Virtual enable	○	○	○	○	○	○	—	○	○	○	○
		Number of steps	1	1	1	1	1	1	1	1	1	1	1
		Number of indirect words	1	—	2	2	1	1	1	2	2	2	1
Position follow-up control	PFSTART	Position follow-up control start	△	○	○	○		△					
Constant-speed control	CPSTART1	1-axis constant-speed control start	△	○		○							
	CPSTART2	2-axes constant-speed control start	△	○		○							
	CPSTART3	3-axes constant-speed control start	△	○		○							
	CPSTART4	4-axes constant-speed control start	△	○		○							
	ABS-1	Constant-speed control passing point absolute specification		○	○			△	△				
	ABS-2			○	○			△	△				
	ABS-3			○	○			△	△				
	ABS-4			○	○			△	△				
	ABS⌒			○	○			△	△	○			
	ABS↷			○	○			△	△		○		
	ABS↻			○	○			△	△		○		
	ABS↶			○	○			△	△		○		
	ABS↺			○	○			△	△		○		
	ABS↷•			○	○			△	△			○	
	ABS↶•			○	○			△	△			○	
	ABH⌒	Constant-speed control passing point helical absolute specification		○	○			△	△	○			○
	ABH↷			○	○			△	△		○		○
	ABH↻			○	○			△	△		○		○
	ABH↶			○	○			△	△		○		○
	ABH↺			○	○			△	△		○		○
	ABH↷•			○	○			△	△			○	○
	ABH↶•			○	○			△	△			○	○

Positioning data																						Number of steps
OSC			*1	Parameter block									Others									
Starting angle	Amplitude	Frequency	Reference axis No.	Control unit	Speed limit value	Acceleration time	Deceleration time	Rapid stop deceleration time	Torque limit value	Deceleration processing at stop input	Allowable error range for circular interpolation	S-curve ratio	Repeat condition	Program No.	Command speed (constant speed)	Cancel	Skip	FIN acceleration/deceleration	WAIT-ON/OFF			
—	—	—	○	—	○	○	○	○	—	—	○	○	○	○	○	○	○	○	○			
1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	2	2	2	1	2			
2	2	2	1	1	2	1	1	1	1	1	2	1	*2 1/ 1(B)	—	2	*2 1(B)	*2 1(B)	1	*2 1(B)			
					△	△	△	△	△	△		△				△						4 to 16
					△	△	△	△	△	△		△				△		△				3 to 15
				△	△	△	△	△	△	△	△	△				△		△				3 to 17
				△	△	△	△	△	△	△	△	△				△		△				4 to17
				△	△	△	△	△	△	△	△	△				△		△				
															△		△		△			2 to 10
															△		△		△			3 to 11
															△		△		△			4 to 12
															△		△		△			5 to 13
															△		△		△			5 to 14
															△		△		△			4 to 13
															△		△		△			
															△		△		△			
															△		△		△			
															△		△		△			5 to 14
															△		△		△			
															△		△		△			9 to 14
															△		△		△			8 to 13
															△		△		△			
															△		△		△			
															△		△		△			
															△		△		△			9 to 14
															△		△		△			

○ : Must be set. △ : Set if required.
*1 : Only reference axis speed specification.
*2 : (B) indicates a bit device.

Table 9.2 Servo Instruction List (continued)

Positioning control	Instruction symbol	Processing		Positioning data										
				Common							Circular			
				Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Pitch
			Virtual enable	○	○	○	○	○	○	—	○	○	○	○
			Number of steps	1	1	1	1	1	1	1	1	1	1	1
			Number of indirect words	1	—	2	2	1	1	1	2	2	2	1
Constant-speed control	INC-1	Constant-speed control passing point incremental specification			○	○			△	△				
	INC-2				○	○			△	△				
	INC-3				○	○			△	△				
	INC-4				○	○			△	△				
	INC ⌒				○	○			△	△	○			
	INC ↶				○	○			△	△		○		
	INC ↻				○	○			△	△		○		
	INC ↷				○	○			△	△		○		
	INC ↺				○	○			△	△		○		
	INC ⌒•				○	○			△	△			○	
	INC ⌣•				○	○			△	△			○	
	INH ⌒	Constant-speed control passing point helical incremental specification			○	○			△	△	○			○
	INH ↶				○	○			△	△		○		○
	INH ↻				○	○			△	△		○		○
	INH ↷				○	○			△	△		○		○
	INH ↺				○	○			△	△		○		○
	INH ⌒•				○	○			△	△			○	○
	INH ⌣•				○	○			△	△			○	○
	CPEND	Constant-speed control end						△						

Positioning data																						Number of steps
OSC			*1	Parameter block									Others									
Starting angle	Amplitude	Frequency	Reference axis No.	Control unit	Speed limit value	Acceleration time	Deceleration time	Rapid stop deceleration time	Torque limit value	Deceleration processing at stop input	Allowable error range for circular interpolation	S-curve ratio	Repeat condition	Program No.	Command speed (constant speed)	Cancel	Skip	FIN acceleration/deceleration	WAIT-ON/OFF			
—	—	—	○	—	○	○	○	○	—	—	○	○	○	○	○	○	○	○	○			
1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	2	2	2	1	2			
2	2	2	1	1	2	1	1	1	1	1	2	1	*2 1/ 1(B)	—	2	*2 1(B)	*2 1(B)	1	*2 1(B)			
															△		△		△			2 to 10
															△		△		△			3 to 11
															△		△		△			4 to 12
															△		△		△			5 to 13
															△		△		△			5 to 14
															△		△		△			4 to 13
															△		△		△			
															△		△		△			
															△		△		△			
															△		△		△			5 to 14
															△		△		△			
															△		△		△			9 to 14
															△		△		△			8 to 13
															△		△		△			
															△		△		△			
															△		△		△			
															△		△		△			9 to 14
															△		△		△			
																						1 to 2

○ : Must be set. △ : Set if required.
*1 : Only reference axis speed specification.
*2 : (B) indicates a bit device.

Table 9.2 Servo Instruction List (continued)

Positioning control	Instruction symbol	Processing	Positioning data										
			Common							Circular			
			Parameter block No.	Axis	Address/travel value	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Pitch
		Virtual enable	○	○	○	○	○	○	—	○	○	○	○
		Number of steps	1	1	1	1	1	1	1	1	1	1	1
		Number of indirect words	1	—	2	2	1	1	1	2	2	2	1
Repetition of same control (used in speed switching control, constant-speed control)	FOR-TIMES	Repeat range start setting											
	FOR-ON												
	FOR-OFF												
	NEXT	Repeat range end setting											
Simultaneous start	START	Simultaneous start											
Home position return	ZERO	Home position return start		○									
High speed oscillation	OSC	High-speed oscillation	△	○				△					
Current Value change	CHGA	Servomotor/Virtual Servomotor Shaft Current Value Change		○	○								
	CHGA-E	Synchronous Encoder Shaft Current Value Change Control		○	○								
	CHGA-C	Cam Shaft Within-One-Revolution Current Value Change Control		○	○								

Positioning data																						Number of steps
OSC			*1	Parameter block									Others									
Starting angle	Amplitude	Frequency	Reference axis No.	Control unit	Speed limit value	Acceleration time	Deceleration time	Rapid stop deceleration time	Torque limit value	Deceleration processing at stop input	Allowable error range for circular interpolation	S-curve ratio	Repeat condition	Program No.	Command speed (constant speed)	Cancel	Skip	FIN acceleration/deceleration	WAIT-ON/OFF			
—	—	—	○	—	○	○	○	○	—	—	○	○	○	○	○	○	○	○	○			
1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	2	2	2	1	2			
2	2	2	1	1	2	1	1	1	1	1	2	1	*2 1/ 1(B)	—	2	*2 1(B)	*2 1(B)	1	*2 1(B)			
													○									2
													○									
													○									
																						3
														○								2 to 3
																						2
○	○	○							△							△						5 to 10
																						3

○ : Must be set. △ : Set if required.
*1 : Only reference axis speed specification.
*2 : (B) indicates a bit device.

9.2 Servomotor/Virtual Servomotor Shaft Current Value Change

The current value of the specified axis is changed in the real mode.
The current value of the specified virtual servomotor shaft is changed in the virtual mode.

			Items set on peripheral device																				
			Common							Circular			Parameter block									Others		
Servo instruction	Positioning method	Number of Control axes	Parameter block No.	Axis	Address/travel	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Control unit	Speed limit value	Acceleration time	Deceleration time	Rapid stop deceleration time	Torque limit value	Deceleration processing at stop input	Allowable error range for circular interpolation	S-curve ratio	Cancel	FIN acceleration/deceleration	Speed change
CHGA	Absolute	1		○	○																			Disable

○ : Item which must be set
△ : Item which is set when required

[Controls]

Control using CHGA instruction

(1) Executing the CHGA instruction changes the current value in the following procedure.

(a) The start accept flag (M2001 to M2008/M2001 to M2032) corresponding to the specified axis is turned on.

(b) The current value of the specified axis is changed to the specified address.

(c) Start accept flag is turned off at completion of the current value change.

(2) The current value of the specified axis is changed in the real mode.

(3) The current value of the specified virtual servo-motor shaft is changed in the virtual mode.

(4) The used axis No. can be set within the following range.

Q172CPU(N)	Q173CPU(N)
Axis 1 to 8	Axis 1 to 32

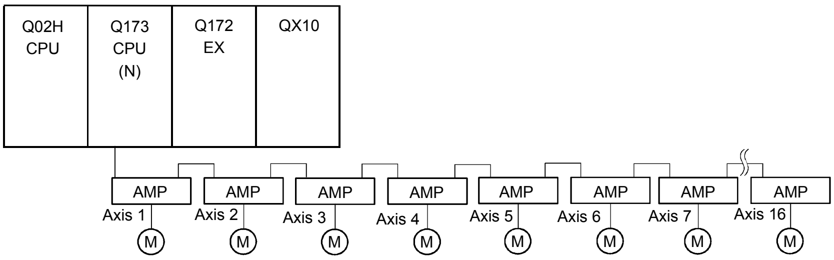
(5) The address which made the current value change by CHGA instruction is valid on the power supply turning on.

[Program example]

A program which made the current value change control in the real mode is described as the following conditions.

(1) System configuration

The current value change control of axis 2 is executed.

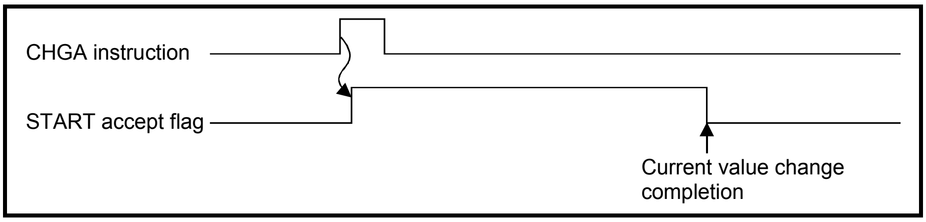


(2) The current value change control conditions

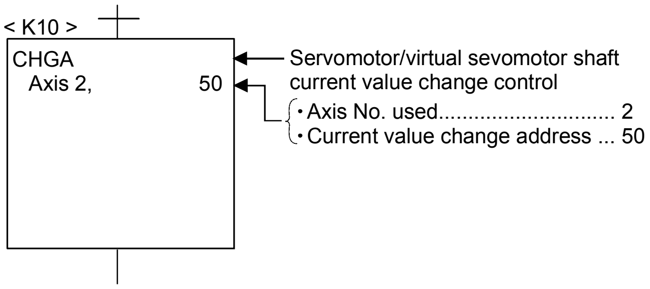
(a) The current value change control conditions are shown below.

Item	Setting
Servo program No.	10
Control axis No.	2
Current value change address	50

(3) Operation timing



(4) Servo program


< K10 >
CHGA
Axis 2,
50
Servomotor/virtual sevomotor shaft current value change control
• Axis No. used............................. 2
• Current value change address ... 50

POINT

(1) Current value changing instructions

- When PLC ready flag (M2000) or PCPU ready flag (M9074) is OFF, a minor error (Note) [100] occurs and a current value change is not made.
- This change is made only during a stop. If a current value change is made while the specified axis is starting, a minor error (Note) [101] (start accept signal of the corresponding axis is ON) occurs and the current value change is not made.
- If the servo of the corresponding axis is not READY, a major error (Note) [1004] occurs and the current value change is not made.
- If the corresponding axis is in a servo error, a major error (Note) [1005] occurs and the current value change is not made.

For SV22

- Set the current value change program of the virtual servomotor shaft within the virtual mode program No. range set in "program mode assignment".
- Set the current value change program of the servomotor (output) shaft within the real mode program No. range.
- If a virtual servomotor shaft current value change is executed in the real mode, a servo program setting error (Note) [903] occurs and the current value change is not made.
- If a servomotor (output) shaft current value change is executed in the virtual mode, a servo program setting error (Note) [904] occurs and the current value change is not made.
- If a current value change is made during mode changing, a servo program setting error (Note) [907] (real → virtual changing) or [908] (virtual → real changing) occurs and the current value change is not made.

(Note) : Refer to the "Q173CPU(N)/Q172CPU(N) Motion controller (SV13/SV22) Programming Manual (REAL MODE)"/"Q173CPU(N)/Q172CPU(N) Motion controller (SV22) Programming Manual (VIRTUAL MODE)" for minor error, major error and servo program setting error.

9.3 Synchronous Encoder Shaft Current Value Change Control (SV22 only)

The current value of the specified synchronous encoder shaft is changed in the virtual mode.

Servo instruction	Positioning method	Number of Control axes	Items set on peripheral device																					Speed change
			Common							Circular			Parameter block									Others		
			Parameter block No.	Axis	Address/travel	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Control unit	Speed limit value	Acceleration time	Deceleration time	Rapid stop deceleration time	Torque limit value	Deceleration processing at stop input	Allowable error range for circular interpolation	S-curve ratio	Cancel	FIN acceleration/deceleration	
CHGA-E	Absolute	1		○	○																			Disable

○ : Item which must be set

△ : Item which is set when required

[Controls]

Control using CHGA-E instruction

(1) Executing the CHGA-E instruction changes the current value of the synchronous encoder shaft in the following procedure.

(a) The synchronous encoder shaft current value changing flag (M2101 to M2112) corresponding to the specified synchronous encoder shaft is turned on.

(b) The current value of the specified synchronous encoder shaft is changed to the specified address.

(c) The synchronous encoder shaft current value changing flag is turned off at completion of the current value change.

(2) The used axis No. can be set within the following range.

Q172CPU(N)	Q173CPU(N)
Axis 1 to 8	Axis 1 to 12

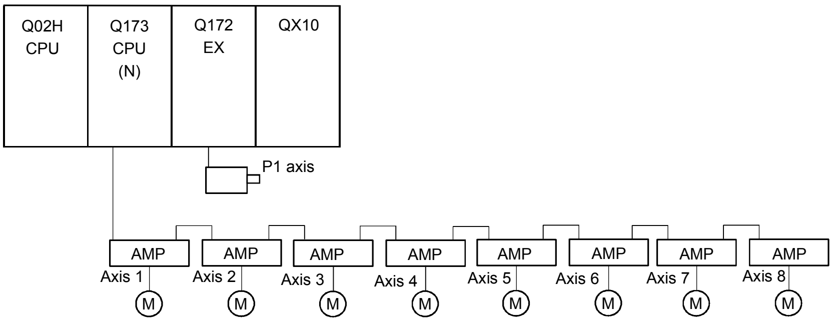
(3) The address which made the current value change by CHGA-E instruction is valid after also the power supply turned off.

[Program example]

A program which made the current value change control of the synchronous encoder shaft is described as the following conditions.

(1) System configuration

The current value change control of the synchronous encoder shaft P1 is executed.

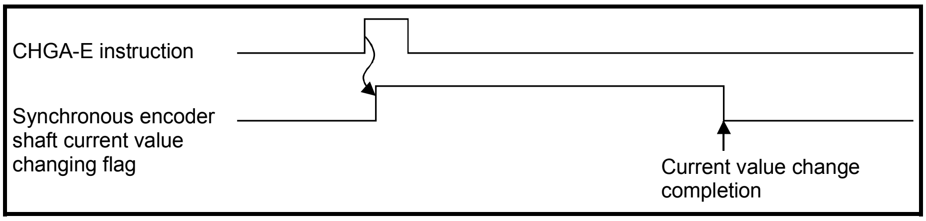


(2) The current value change control conditions

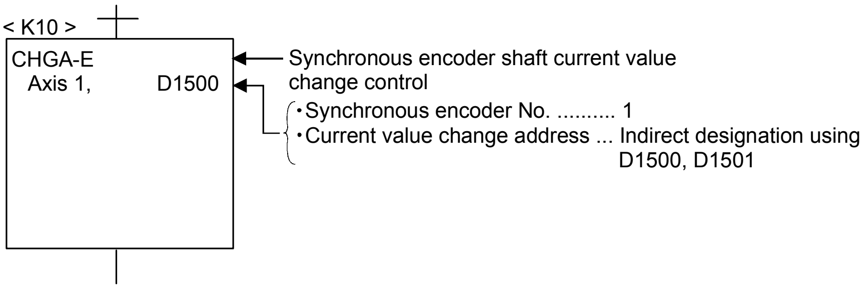
(a) The current value change control conditions are shown below.

Item	Setting
Servo program No.	10
Synchronous encoder No.	1
Current value change address	Indirect designation using D1500, D11501

(3) Operation timing


CHGA-E instruction
Synchronous encoder shaft current value changing flag
Current value change completion

(4) Servo program



```
< K10 >
CHGA-E
  Axis 1,        D1500
```

Synchronous encoder shaft current value change control

- Synchronous encoder No. 1
- Current value change address ... Indirect designation using D1500, D1501

POINT

(1) Synchronous encoder current value changing instructions

- The current value change of the synchronous encoder is executed if operation is being performed in the virtual mode (during pulse input from the synchronous encoder).
  If the current value is changed, the feed current value of the synchronous encoder continues from the new value.
- The current value change of the synchronous encoder does not affect the current value of the output module.
- Set the current value change program of the synchronous encoder shaft program within the virtual mode program No. range set in "program mode assignment".
- When PLC ready flag (M2000) or PCPU ready flag (M9074) is OFF, a minor error (Note) [100] occurs and a current value change is not made.
- If a synchronous encoder current value change is executed in the real mode, a servo program setting error (Note) [903] or [905] occurs and the current value change is not made. ([903] when the current value change servo program is set to within the virtual mode program No. range, or 905 when it is set to within the real mode program No. range.)
- If a current value change is made during mode changing, a servo program setting error (Note) [907] (real → virtual changing) or [908] (virtual → real changing) occurs and the current value change is not made.

(Note) : Refer to the "Q173CPU(N)/Q172CPU(N) Motion controller (SV13/SV22) Programming Manual (REAL MODE)"/"Q173CPU(N)/Q172CPU(N) Motion controller (SV22) Programming Manual (VIRTUAL MODE)" for minor error, major error and servo program setting error.

9.4 Cam Shaft Within-One-Revolution Current Value Change Control (SV22 only)

The current value of the specified cam shaft within-one-revolution is changed in the virtual mode.

Servo instruction	Positioning method	Number of Control axes	Items set on peripheral device																					Speed change
			Common							Circular			Parameter block									Others		
			Parameter block No.	Axis	Address/travel	Command speed	Dwell time	M-code	Torque limit value	Auxiliary point	Radius	Central point	Control unit	Speed limit value	Acceleration time	Deceleration time	Rapid stop deceleration time	Torque limit value	Deceleration processing at stop input	Allowable error range for circular interpolation	S-curve ratio	Cancel	FIN acceleration/deceleration	
CHGA-C	Absolute	1		○	○																			Disable

○ : Item which must be set
△ : Item which is set when required

[Controls]

Control using CHGA-C instruction

(1) Executing the CHGA-C instruction changes the within-one-revolution current value of the specified cam shaft to the address.

(2) The cam shaft may be starting.

(3) The used axis No. can be set within the following range.

Q172CPU(N)	Q173CPU(N)
Axis 1 to 8	Axis 1 to 32

(4) The address which made the current value change by the CHGA-C instruction is valid after also the power supply turned off.

[Program example]

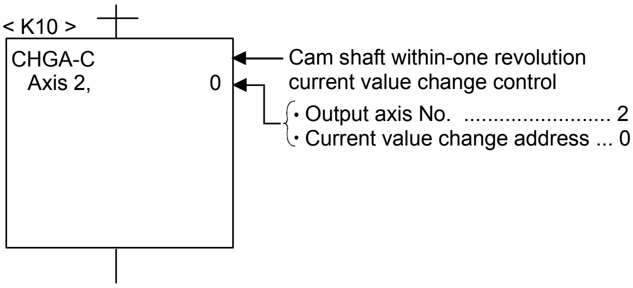
A program which made the current value change control of the cam shaft within-one-revolution current value change is described as the following conditions.

(1) Current value change control conditions

(a) The current value change control conditions are shown below.

Item	Setting
Servo program No.	10
Output axis No.	2
Current value change address	0

(2) Servo program


< K10 >
CHGA-C
Axis 2,
0
Cam shaft within-one revolution current value change control
• Output axis No. 2
• Current value change address ... 0

POINT

(1) Cam shaft within-one revolution current value changing instructions

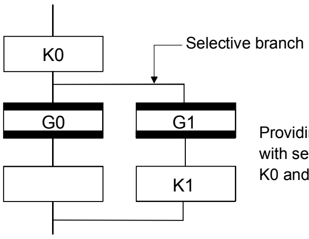
- If a new within-one revolution current value is outside the range 0 to (one-revolution pulse count - 1), a minor error (Note) [6120] occurs and current value change is not.
- Set the current value change program the cam shaft within-one-revolution within the virtual mode program No. range set in "program mode assignment".
- When PLC ready flag (M2000) or PCPU ready flag (M9074) is OFF, a minor error (Note) [100] occurs and a current value change is not made.
- If the cam shaft within-one-revolution current value change is executed in the real mode, a servo program setting error (Note) [903] or [905] occurs and the current value change is not made. ([903] when the current value change servo program is set to within the virtual mode program No. range, or 905 when it is set to within the real mode program No. range.)
- If a current value change is made during mode changing, a servo program setting error (Note) [907] (real → virtual changing) or [908] (virtual → real changing) occurs and the current value change is not made.

(Note) : Refer to the "Q173CPU(N)/Q172CPU(N) Motion controller (SV13/SV22) Programming Manual (REAL MODE)"/"Q173CPU(N)/Q172CPU(N) Motion controller (SV22) Programming Manual (VIRTUAL MODE)" for minor error, major error and servo program setting error.

9.5 Programming Instructions

9.5.1 Cancel • start

When a cancel start has been set in the setting items of the servo program which was started at the motion control step of the Motion SFC program, the cancel of the running servo program is valid but the servo program specified to start after a cancel is ignored, without being started.
The following example shows the Motion SFC program which exercises control equivalent to a cancel start.



Providing transition G1 with cancel device condition specified with servo program K0 will cancel to execute of servo program K0 and allow servo program K1 to start.

9.5.2 Indirect designation using motion devices

(1) The motion registers #0 to #8191 cannot be used to make indirect specification in the mechanical system programs.
The motion register values are used in the servo or mechanical system programs, substitutes them to data registers (D)/link registers (W).

(2) The coasting timer (FT) cannot used to make indirect specification in the servo program and mechanical system program.

10. MOTION DEVICES

The motion registers (#0 to #8191) and coasting timer (FT) are available as Motion CPU-dedicated devices.
They can be used in operation control (F/FS) programs or transition (G) programs.

10.1 Motion Registers (#0 to #8191)

Motion device	Item	Specifications
Motion register (#)	Number of points	8192 points (#0 to #8191)
	Data size	16-bit/point
	Latch	Only a user device is latched. (All points are cleared by latch clear operation.)
	Usable tasks	Normal, event and NMI
	Access	Read and write enabled in whole range

(1) Motion register list
- Common to all operating system

Device No.	Application	Signal direction
#0 to	User devices (8000 points)	• Cleared by latch clear.
#8000 to	Motion SFC dedicated devices (64 points)	• Cleared at power on or reset only. (Note-1) • Cleared by the Motion SFC error history request flag on (keep at power on or reset). (Note-2)
#8064 to #8191	Servo monitor devices (128 points)	• Cleared at power on or reset only.

(Note-1) : SW6RN-SV13Q□/SV22Q□ (Ver. 00M or before)
(Note-2) : SW6RN-SV13Q□/SV22Q□ (Ver. 00N or later)

POINT

The motion registers (#) cannot be set as indirectly specified devices of mechanical system programs.

(a) Motion SFC dedicated devices (#8000 to #8063)

The Motion SFC dedicated devices are shown below.
The device's refresh cycle is indicated when the signal direction is "status", or its fetch cycle when the signal direction is "command".

Device No.	Signal name		Signal direction		Refresh cycle	Fetch cycle
			Status	Command		
#8000 to	Seventh error information in past (Oldest error information)	Motion SFC error history (8 errors) (64 points)	○	—	At error occurrence	—
#8008 to	Sixth error information in past					
#8016 to	Fifth error information in past					
#8024 to	Fourth error information in past					
#8032 to	Third error information in past					
#8040 to	Second error information in past					
#8048 to	First error information in past					
#8056 to #8063	Latest error information					

1) Motion SFC error history devices

The error information which occurred after power-on of the CPU is stored as a history of up to eight past errors. The latest error is stored in #8056 to #8063. All errors, including the Motion SFC control errors and the conventional minor, major, servo, servo program and mode changing errors are stored in this history. At error occurrence, the "Motion SFC error detection flag (M2039)" is also set.

The error information is shown below.

No.	Signal name		Description	
			Motion SFC control errors	Conventional errors
+0	Error Motion SFC program No.		0 to 255 : Motion SFC program No. in error -1 : Independent of Motion SFC program	-1
+1	Error type		1 :F/FS 2 :G -1 :K or other (not any of F/FS, G and SFC chart) -2 :Motion SFC chart	3 : Minor/major error 4 : Minor/major error (virtual servomotor shaft) (SV22 only) 5 : Minor/major error (synchronous encoder shaft) (SV22 only) 6 : Servo error 7 : Servo program error 8 : Mode change error (SV22 only) 9 : Manual pulse generator axis setting error 10 : Test mode request error 11 : WDT error 12 : Personal computer link communication error
+2	Error program No.		0 to 4095 : F/FS, G, K program No. 0 to 255 : GSUB program No. -1 : Independent of F/FS, G, K, GSUB	0 to 4095 : Servo program No. when error type is "3", "4" or "7" -1 : Others
+3	Error block No./ Motion SFC list line No./axis No.		0 to 8191 : F/FS or G program's block No. (line No.) when error type is "1" or "2" 0 to 8188 : Motion SFC list line No. when error type is "-2" -1 : Independent of block when error type is "-1" or error type is "1" or "2"	1 to 32 : Corresponding axis No. when error type is any of "3" to "6" -1 : Others
+4	Error code		16000 and later (Refer to Chapter "19 ERROR CODE LISTS".)	• Conventional error code (less than 16000) when error type is any of "3" to "6" • Error code stored in D9190 when error type is "7" • Error code stored in D9193 when error type is "8" • -1 when error type is "9" or "10" • Error code stored in D9184 when error type is "11" • Error code stored in D9196 when error type is "12"
+5	Error occur-rence time	Year/ month	The clock data (D9025, D9026, D9027) are set. (BCD code, year in its lower 2 digits)	
+6		Day/ hour		
+7		Minute/ second		

2) Motion SFC error detection flag (M2039)
(Refresh cycle : Scan time)
The Motion SFC error detection flag (M2039) turns on when any of the errors detected by the Motion CPU occurs.
At error occurrence, data are set to the error devices in the following procedure.

a) Set the error code to each axis or error devices.

b) Turns on the error detection signal of each axis or error.

c) Set the error information to the above "Motion SFC error history devices (#8000 to #8063)".

d) Turns on the Motion SFC error detection flag (M2039) .

In the user program, reset the "Motion SFC error detection flag (M2039)" after reading the error history at the "Motion SFC error detection flag (M2039)".
After that, "Motion SFC error detection flag (M2039)" turns on again at occurrence of a new error.

POINT

(1) Resetting the "Motion SFC error detection flag (M2039)" will not reset (clear to zero) the "Motion SFC error history devices (#8000 to #8063)".
After power-on, they always controls the error history continuously.

(2) Set the clock data and clock data read request (M9028) in the user program.

(b) Servo monitor devices (#8064 to #8191)

Information about "servo amplifier type", "motor current" and "motor speed" for each axis is stored the servo monitor devices.
The details of the storage data are shown below.

Axis No.	Device No.	Signal name
1	#8064 to #8067	
2	#8068 to #8071	
3	#8072 to #8075	
4	#8076 to #8079	
5	#8080 to #8083	
6	#8084 to #8087	
7	#8088 to #8091	
8	#8092 to #8095	
9	#8096 to #8099	
10	#8100 to #8103	
11	#8104 to #8107	
12	#8108 to #8111	
13	#8112 to #8115	
14	#8116 to #8119	
15	#8120 to #8123	
16	#8124 to #8127	
17	#8128 to #8131	
18	#8132 to #8135	
19	#8136 to #8139	
20	#8140 to #8143	
21	#8144 to #8147	
22	#8148 to #8151	
23	#8152 to #8155	
24	#8156 to #8159	
25	#8160 to #8163	
26	#8164 to #8167	
27	#8168 to #8171	
28	#8172 to #8175	
29	#8176 to #8179	
30	#8180 to #8183	
31	#8184 to #8187	
32	#8188 to #8191	

	Signal name [Note-1]	Signal description	Refresh cycle	Signal direction
+0	Servo amplifier type	0 : Unused 4 : MR-J2S-B 1 : MR-H-BN 5 : MR-J2-M 2 : MR-J-B 6 : MR-J2-03B5 3 : MR-J2-B 65 : FR-V500	When the servo amplifier power-on	Monitor device
+1	Motor current	-5000 to 5000 (×0.1[%])	3.55ms	
+2	Motor speed	-50000 to 50000 (×0.1[r/min])		
+3				

(Note-1) : The value that the lowest servo monitor device No. was added "+0, +1 ···" on each axis is shown.

REMARK

The servo monitor devices (#8064 to #8191) is effective with SW6RN-SV13Q□/SV22Q□ (Ver.00D or later).

10.2 Coasting Timer (FT)

Motion device	Item	Specification
Coasting timer (FT)	Number of points	1 point (FT)
	Data size	32-bit/point (-2147483648 to 2147483647)
	Latch	No latch. Cleared to zero at power-on or reset, a count rise is continued from now on.
	Usable tasks	Normal, event, NMI
	Access	Read only enabled
	Timer specifications	888μs timer (Current value (FT) is incremented by 1 per 888μs.)

11. MOTION SFC PARAMETER

Two different Motion SFC parameters are available: "task parameters" designed to control the tasks (normal task, event task, NMI task) and "program parameters" to be set per Motion SFC program.
Their details are shown below.

11.1 Task Definitions

When to execute the Motion SFC program processing can be set only once in the program parameter per program.
Roughly classified, there are the following three different tasks.

Task type	Contents
Normal task	Executes in motion main cycle (free time).
Event task	1. Executes in fixed cycle (0.88ms, 1.77ms, 3.55ms, 7.11ms, 14.2ms). 2. Executes when the input set to the event task factor among external interrupts (16 points of QI60) turns on. 3. Executes by an interrupt from the PLC CPU.
NMI task	Executes when the input set to the NMI task factor among external interrupts (16 points of QI60) turns on.

11.2 Number of Consecutive Transitions and Task Operation

11.2.1 Number of consecutive transitions

With "execution of active step → judgment of next transition condition → transition processing performed when condition enables (transition of active step)" defined as a single basic operation of the Motion SFC program execution control in the execution cycle of the corresponding task, this operation is performed for the number of active steps to terminate processing once. And the same operation is processed continuously in the next cycle.
In this case, the transition destination step is executed in the next cycle when the transition condition enables.

Consecutive transition control indicates that transition destination steps are executed one after another in the same one execution cycle when their transition conditions have enabled (single basic operation is performed consecutively).
In this case, set the number of consecutive transitions.
Control exercised is common to the Motion SFC programs executed by normal tasks.

POINT

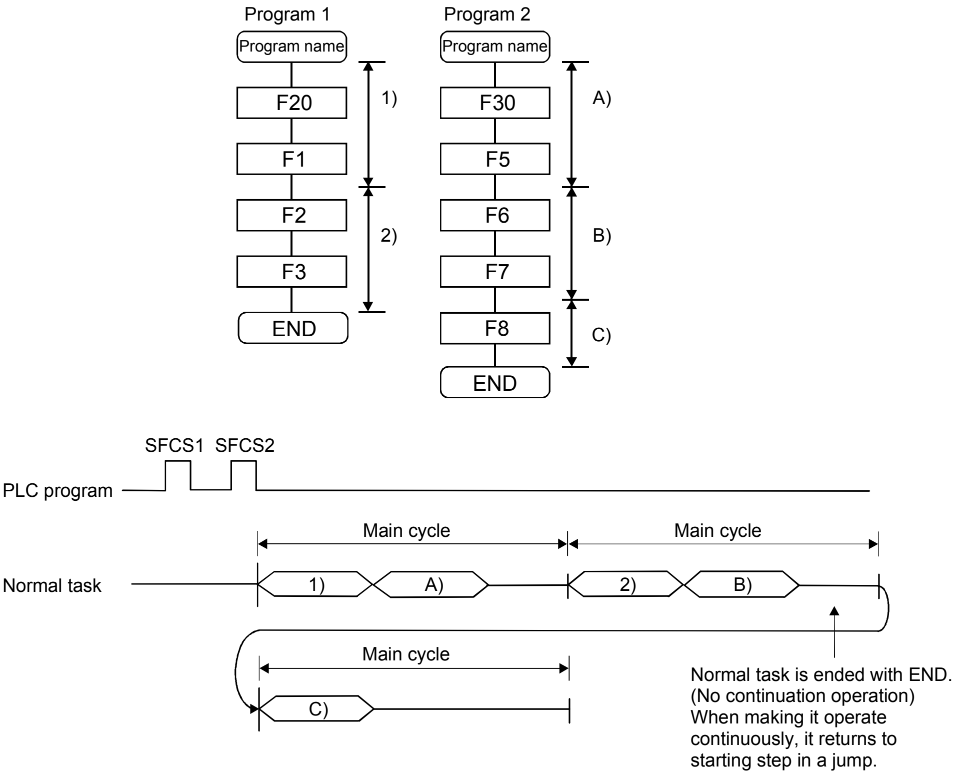
Set the number of consecutive transitions to the Motion SFC programs executed by event and NMI tasks for every program.

11.2.2 Task operation

(1) Normal task operation

[Operations]

The Motion SFC program is executed in the main cycle (free time) of the Motion CPU processing.



Normal task is ended with END. (No continuation operation) When making it operate continuously, it returns to starting step in a jump.

[Points]

(a) The Motion SFC program which includes motion control steps should be set to a normal task.

(b) During execution of an event or NMI task, the execution of the normal task is suspended.
Note that since the normal task allows the event task disable instruction (DI) to be described in an operation control step, the event task can be disabled in the area enclosed by the event task disable instruction (DI) and event task enable instruction (EI).

(2) Event task operation

[Operations]

An event task executes the Motion SFC program at occurrence of an event. There are the following events.

(a) Fixed cycle

The Motion SFC program is executed periodically in any of 0.88ms, 1.77ms, 3.55ms, 7.11ms and 14.2ms cycles.

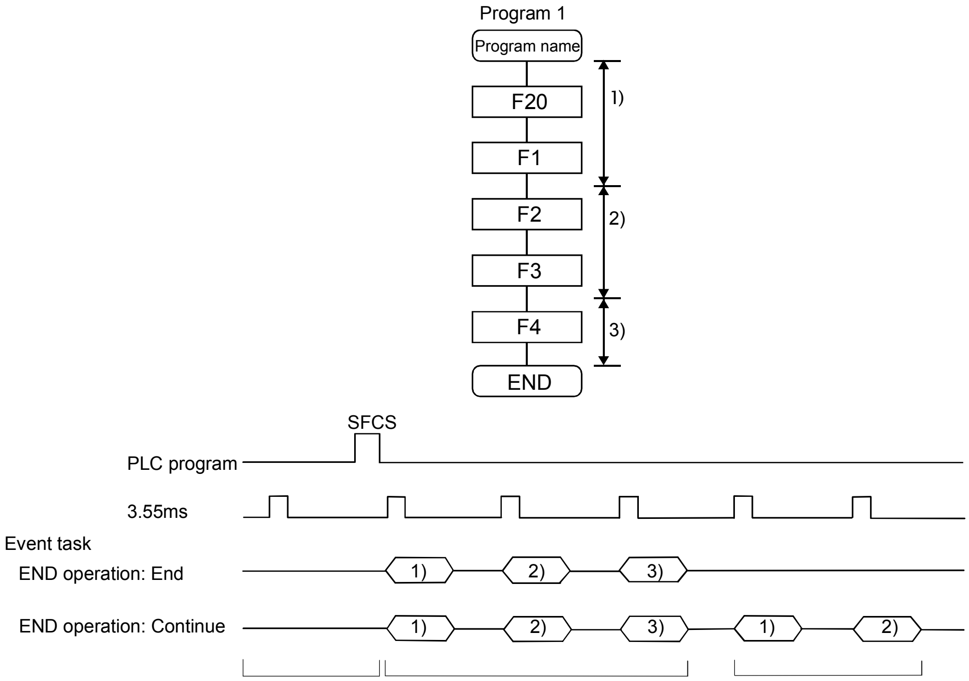
(b) External interrupt (16 points of I0 to I15)

Among 16 points of the QI60 (16-point interrupt module) loaded in the motion slot, the Motion SFC program is run when the input set for an event task turns on.

(c) PLC interrupt

The Motion SFC program is executed when the S(P).GINT instruction is executed in the PLC program.

<Example 1>

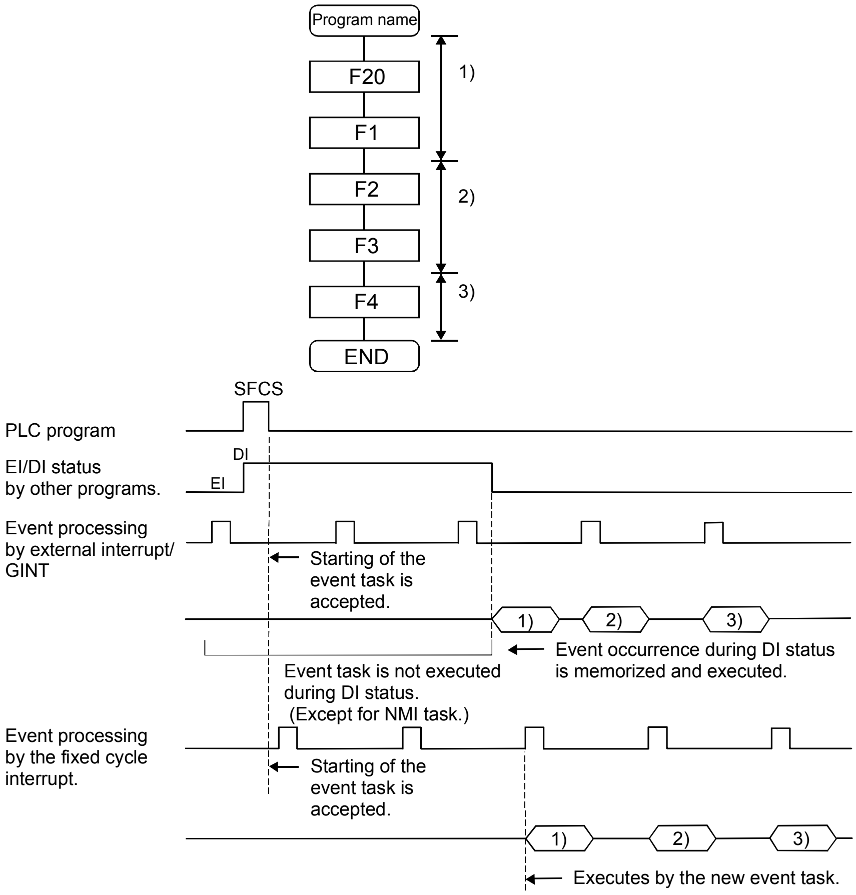


Do not execute a program before the event task starting .
(Note) : When making it always execute, set as automatic starting.

Execute the number of consecutive transition for every event occurrence.

When END operation is set as continuation, continuation operation is executed.
When stopping, it is make to execute CLR by other programs.

<Example 2>



[Points]

(a) Multiple events can be set to one Motion SFC program. However, multiple fixed cycles cannot be set.

(b) Multiple Motion SFC programs can be executed by one event.

(c) Motion control steps cannot be executed during the event task.

(d) The event task cannot be executed when it is disabled by the normal task. The event that occurred during event task disable is executed the moment the event task is enabled.

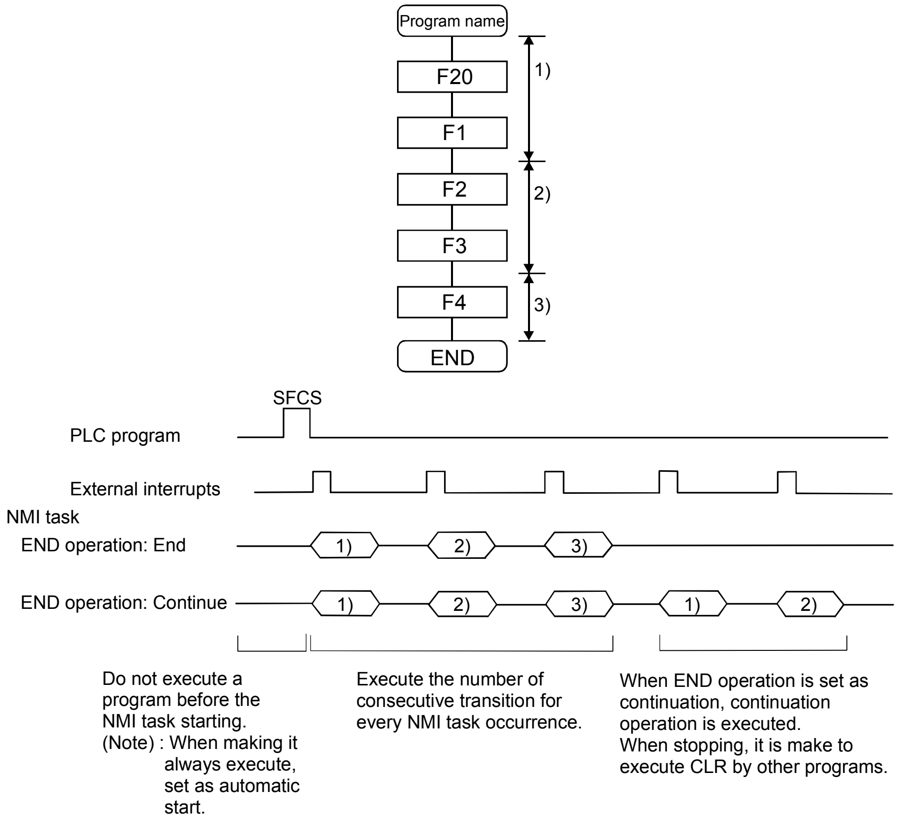
[Errors]

When the motion control step is executed by the Motion SFC program set to the event task, the Motion SFC program error [16113] occurs and stops the Motion SFC program running.

(3) NMI task operation

[Operations]

The Motion SFC program is executed when the input set to the NMI task factor among external interrupts (16 points of QI60) turns on.



Do not execute a program before the NMI task starting.
(Note) : When making it always execute, set as automatic start.

Execute the number of consecutive transition for every NMI task occurrence.

When END operation is set as continuation, continuation operation is executed.
When stopping, it is make to execute CLR by other programs.

[Points]

(a) NMI task has the highest priority among the normal, event and NMI tasks.

(b) If the event task is disabled (DI) by the normal task, the interruption of the NMI task is executed, without being masked.

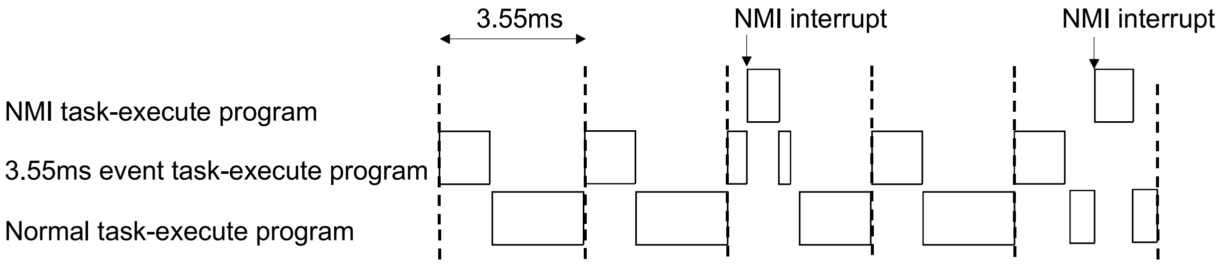
[Errors]

The motion control step is executed during NMI task.

If the motion control step is executed during NMI task, the Motion SFC program error [16113] occurs and stops the Motion SFC program.

11.3 Execution Status of The Multiple Task

Execution status of each Motion SFC program when the Motion SFC program is executed multiple tasks is shown below.


3.55ms
NMI interrupt
NMI interrupt
NMI task-execute program
3.55ms event task-execute program
Normal task-execute program

When there are programs which are executed by the NMI task, 3.55ms fixed-cycle even task with a program to run by the NMI task, and the normal task like a chart,

(1) The 3.55ms fixed-cycle event task is executed at intervals of 3.55ms;

(2) The NMI task is executed with the highest priority when an NMI interrupt is input; and

(3) The normal task is executed at free time.
as shown above.

[Points]
One Motion SFC program can be executed partially by another task by setting the area to be executed by another task as a subroutine and setting a subroutine running task as another task.
<Example>

No. 0 Main Motion SFC program	Normal task
No. 1 Subroutine	Event task (3.55ms cycle)

⚠CAUTION

● A normal task may be hardly executed when a NMI task, an event task are executed in many.

11.4 Task Parameters

No.	Item		Setting item	Initial value	Remark
1	Number of consecutive transitions	Normal task (Normal task common)	1 to 30	3	These parameters are imported when PLC ready flag (M2000) turns off to on and used for control thereafter. When setting/changing the values of these parameters, turns the PLC ready flag (M2000) off.
2	Interrupt setting		Set whether the event task or NMI task is used for external interrupt inputs (I0 to I15).	Event task	

(1) Number of consecutive transitions

[Description]

With "execution of active step → judgment of next transition condition → transition processing performed when condition enables (transition of active step)" defined as a single basic operation of the Motion SFC program execution control in the execution cycle of the corresponding task, this operation is performed for the number of active steps to terminate processing once. And the same operation is processed continuously in the next cycle.
In this case, the transition destination step is executed in the next cycle when the transition condition enables.

Consecutive transition control indicates that transition destination steps are executed one after another in the same one execution cycle when their transition conditions have enabled (single basic operation is performed consecutively).
In this case, the number of consecutive transitions can be set.
Controls in common to the Motion SFC programs executed by normal tasks.

POINT

Set the number of consecutive transitions to the Motion SFC programs executed by event and NMI tasks for every program.

[Errors]

These parameters are imported and checked when the PLC ready flag (M2000) turns off to on.
When the value that was set is outside the setting range, the following Motion SFC error is set and the initial value is used to control.

Error code (Note)	Error cause		Error processing	Corrective action
	Name	Contents		
17000	Normal task consecutive transition count error	The normal task's consecutive transition count of the Motion SFC program executed by the normal task is outside the range 1 to 30.	The initial value of 3 is used for control.	Turn PLC ready flag (M2000) off, make correction to set the value of within the range, and write it to the CPU.

(Note) : 0000H (normal)

(2) Interrupt setting

[Description]
Set whether 16 interrupt input points (I0 to I15) of the QI60 interrupt module loaded in the motion slot are used as NMI or event task inputs.
Setting can be made freely per point.
All points default to event tasks.

[Errors]
None.

11.5 Program Parameters

Set the following parameters for every Motion SFC program.

No.	Item	Setting range	Initial value	Remark
1	Start setting	Automatically started or not	Not setting	These parameters are imported at starting of the PLC ready flag (M2000) and used for control there after. When setting/changing the values of these parameters, turn PLC ready flag (M2000) off.
2	Execute task	It is only one of normal, event and NMI tasks	Normal task	
		When you have set the event task, further set the event which will be enabled. Always set any one of the following 1 to 3. 1. Fixed cycle It is one of 0.88ms, 1.77ms, 3.55ms, 7.11ms and 14.2ms or none. 2. External interrupt (make selection from those set to event task) Multiple interrupt can be set from among I0, I1, I2, I3, I4, I5, I6, I7, I8, I9, I10, I11, I12, I13, I14 and I15. 3. PLC interrupt Multiple interrupt can be set from among I0, I1, I2, I3, I4, I5, I6, I7, I8, I9, I10, I11, I12, I13, I14 and I15. 1 to 3 can be set also by OR. (A duplication setting is possible.) The same event can be shared among multiple Motion SFC programs.	None	
		When you have set the NMI task, further set the interrupt input which will be enabled. 1. External interrupt (make selection from those set to NMI task) Multiple interrupt can be set from among I0, I1, I2, I3, I4, I5, I6, I7, I8, I9, I10, I11, I12, I13, I14 and I15.		
3	Number of consecutive transitions	1 to 10 Set the number of consecutive transitions toward the program set to the event or NMI task.	1	
4	END operation	End/continue Set the operation mode of the END step toward the program set to the event or NMI task.	End	

POINT

The settings of "END operation" are invalid for the subroutine called program.
"END operation" is controlled as "end".

(1) Start setting

[Description]

The following control is changed by "automatically started or not" setting.

- Program run by normal task

No.	Item	When "automatically started"	When "not automatically started"
1	Start control	In the main cycle after the PLC ready flag (M2000) turns off to on, the program is executed from the initial (first) step in accordance with the number of consecutive transitions of the normal task.	The program is started by the Motion SFC start instruction (S(P).SFCS) from the PLC or by a subroutine call/start (GSUB) made from the Motion SFC program. • When started by the S(P).SFCS instruction In the main cycle after execution of the S(P).SFCS instruction, the program is executed from the initial (first) step in accordance with the number of consecutive transitions of the normal task. • When subroutine started In the (next) main cycle after execution of GSUB, the program is executed from the first step in accordance with the number of consecutive transitions of the normal task. • When subroutine called The program is executed in the same cycle from the first step.
		After that, the program is executed continuously by the number of consecutive transitions of the normal task in the motion main cycle. (The settings of "executed task" and "number of consecutive transitions" of the subroutine called program are invalid. It is controlled as the normal task.)	

2	END control
	END
		Ends the self program.
		Again, the program is started by the Motion SFC start instruction (S(P).SFCS) from the PLC or by a subroutine call/start (GSUB) made from the Motion SFC program.	

- Program run by event task

No.	Item	When "automatically started"	When "not automatically started"
1	Start control	At occurrence of a valid event after starting of the PLC ready flag (M2000), the program is executed from the initial (first) step in accordance with the number of consecutive transitions of the corresponding program.	The program is started by the Motion SFC start instruction (S(P).SFCS) from the PLC or by a subroutine call/start (GSUB) made from within the Motion SFC program. • When started by the S(P).SFCS instruction At occurrence of a valid event after execution of the S(P).SFCS instruction, the program is run from the initial (first) step in accordance with the number of consecutive transitions of the corresponding program. • When subroutine started At occurrence of a valid event after execution of GSUB, the program is executed from the first step in accordance with the number of consecutive transitions of the corresponding program. • When subroutine called The program is executed immediately from the first step.
		After that, the program is executed continuously by the number of consecutive transitions of the corresponding program at occurrence of a valid event. (The subroutine called program is controlled in accordance with the "executed task" and "number of consecutive transitions" of the call source program.)	

2	END control
	END
		As specified for END operation.	

- Program run by NMI task

No.	Item	When "automatically started"	When "not automatically started"
1	Start control	At occurrence of a valid event after starting of the PLC ready flag (M2000), the program is executed from the initial (first) step in accordance with the number of consecutive transitions of the corresponding program.	The program is started by the Motion SFC start instruction (S(P).SFCS) from the PLC or by a subroutine call/start (GSUB) made from within the Motion SFC program. • When started by the S(P).SFCS instruction At occurrence of a valid event after execution of the S(P).SFCS instruction, the program is run from the initial (first) step in accordance with the number of consecutive transitions of the corresponding program. • When subroutine started At occurrence of a valid event after execution of GSUB, the program is executed from the first step in accordance with the number of consecutive transitions of the corresponding program. • When subroutine called The program is executed immediately from the first step.
		After that, the program is executed continuously by the number of consecutive transitions of the corresponding program at occurrence of a valid event.	

2	END control
	END
		As specified for END operation.	

[Errors]
None.

POINT

In the case of the program which is executed by the normal task, write the program so that it is not ended by END but it returns to the starting step by a jump when starting of the automatically from an initial again.

(2) Execute task

[Description]

Set the timing (task) to execute a program.

Specify whether the program will be run by only one of the "normal task (main cycle), event task (fixed cycle, external interrupt, PLC interrupt) and NMI task (external interrupt)".

When the event task is set, multiple events among the "fixed cycle, external interrupt (for event task) and PLC interrupt".

However, multiple fixed cycles cannot be set toward one Motion SFC program.

Example) Interrupt setting: Inputs for event task I6, I7, I8, I9, I10, I11, I12, I13, I14 and I15

Motion SFC program No. 10 – event : Fixed cycle (3.55ms)

Motion SFC program No. 20 – event :
Fixed cycle (1.77ms) + external interrupt (I6)

Motion SFC program No. 30 – event :
External interrupts (I7, I15) + PLC CPU interrupt

When the NMI task is set, multiple interrupt inputs among the external interrupts (for NMI task) can be set.

Example) Interrupt setting: Inputs for NMI task I0, I1, I2, I3, I4, I5

Motion SFC program No. 10 – NMI : I0

Motion SFC program No. 20 – NMI : I1 + I2

Motion SFC program No. 30 – NMI : I5

[Errors]

This program parameter is imported when the PLC ready flag (M2000) turns off to on, and is checked at starting of the Motion SFC program (automatic start, start from PLC or subroutine start).

When the value is illegal, either of the following Motion SFC errors is set and the initial value is controlled.

Error code (Note)	Error cause		Error processing	Corrective action
	Name	Contents		
17010	Execute task setting is illegal	Multiple events among the normal, event and NMI tasks are set, or one is not set.	The initial value (normal task) is controlled.	Turn PLC ready flag (M2000) off, make correction to set the value of within the range, and write it to the CPU.
17011	Executed task setting is illegal (event)	Two or more fixed cycles of the event task have been set.		

(Note) : 0000H (normal)

POINT

Since the execute task can be set for every Motion SFC program No., multiple programs need not be written for single control (machine operation) to divide execution timing-based processing's.

For example, it can be achieved easily by subroutine starting the areas to be run in fixed cycle and to be run by external interrupt partially in the Motion SFC program run by the normal task.

(3) Number of consecutive transitions

[Description]

Set the number of consecutive transitions to program executed by the event or NMI task for every program.

Refer to Section "11.4 Task Parameters" for number of consecutive transitions.

[Errors]

This program parameter is imported when the PLC ready flag (M2000) turns off to on, and is checked at starting of the Motion SFC program (automatic start, start from PLC or subroutine start).

When the value is illegal, either of the following Motion SFC errors is set and the initial value is controlled.

Error code	Error cause		Error processing	Corrective action
(Note)	Name	Contents		
17001	Event task consecutive transition count error	The number of consecutive transitions of the Motion SFC program started by the event task is outside the range 1 to 10.	The initial value of 1 is controlled.	Turn PLC ready flag (M2000) off, make correction to set the value of within the range, and write it to the CPU.
17002	NMI task consecutive transition count error	The number of consecutive transitions of the Motion SFC program started by the NMI task is outside the range 1 to 10.		

(Note) : 0000H (normal)

(4) END operation

[Description]

Set the operation at execution of the END step toward the program executed by the event or NMI task.

This varies the specifications for the following items.

- Program run by NMI task

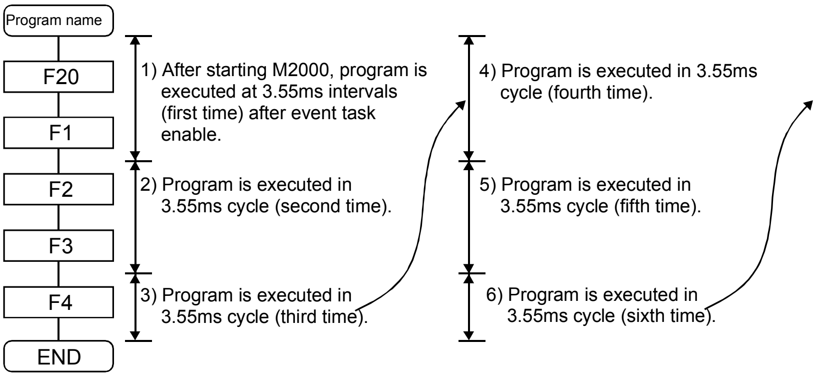
No.	Item	When "ended"	When "continued"
1	Control at END execution	Ends the self program.	Ends to execute the self program with this event/interrupt.
2	Restart after END execution	Again, the program is started by the Motion SFC start instruction (S(P).SFCS) from the PLC or by a subroutine call/start (GSUB) made from the Motion SFC program.	Restarted at occurrence of the next event/interrupt, and run from the initial (first) step in accordance with the number of consecutive transitions of the corresponding program. After that, at occurrence of an event/interrupt, the program is executed in accordance with the number of consecutive transitions of the corresponding program.
3	Restart after end by clear step CLR	Again, the program is started by the Motion SFC start instruction (S(P).SFCS) from the PLC or by a subroutine call/start (GSUB) made from the Motion SFC program.	

POINT

The END operation of subroutine called program is controlled as an "end".

- The following operation example assumes that the END operation is "continued."

  Program parameters
  - Automatically started
  - Execute task = event 3.55ms
  - Number of consecutive transitions = 2
  - End operation "continued"



1) After starting M2000, program is executed at 3.55ms intervals (first time) after event task enable.

2) Program is executed in 3.55ms cycle (second time).

3) Program is executed in 3.55ms cycle (third time).

4) Program is executed in 3.55ms cycle (fourth time).

5) Program is executed in 3.55ms cycle (fifth time).

6) Program is executed in 3.55ms cycle (sixth time).

11.6 How to Start The Motion SFC Program

The Motion SFC program is executed during PLC ready flag (M2000) is on.
The Motion SFC program may be started by any of the following three methods.

(1) Automatic start
(2) Start from the Motion SFC program
(3) Start from the PLC

Set the starting method in the program parameter for every Motion SFC program.
Refer to Section "11.5 Program Parameters" for parameter setting.

11.6.1 Automatic start

[Operations]
An automatic start is made by turning PLC ready flag (M2000) on.

11.6.2 Start from the Motion SFC program

[Operations]
A start is made by executing a subroutine call/start step in the SFC program.
Refer to Chapter "6 MOTION SFC PROGRAMS" for details of the subroutine call/start step.

11.6.3 Start from PLC (PLC instruction S(P).SFCS)

The SFC program can started by executing the S(P).SFCS in the PLC program.

Refer to Chapter "5 MOTION DEDICATED PLC INSTRUCTION" for details.

11.7 How to End The Motion SFC Program

[Operations]

(1) The Motion SFC program is ended by executing END set in itself.

(2) The Motion SFC program is stopped by turning off the PLC ready flag (M2000).

(3) The program can be ended by the clear step.
Refer to Section "6.5.4 Clear step" for details of the clear step.

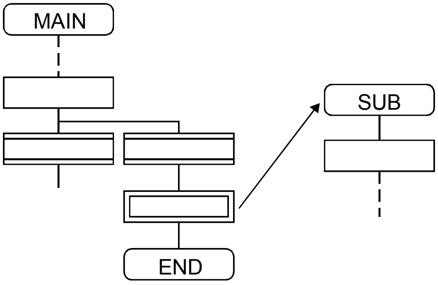
[Point]

(1) Multiple ENDs can be set in one Motion SFC program.

11.8 How to Change from One Motion SFC Program to Another

Use a subroutine start to stop the Motion SFC program running and switch it to another Motion SFC program.

Motion SFC program changing example using subroutine start



11.9 How to Manage The Executing Program

There are no specific information that indicates which the Motion SFC program is executing. Use a user program (Motion SFC program/PLC program) to control the executing program.

11.10 Operation Performed at CPU Power-Off or Reset

When the CPU is powered off or reset operation is performed, Motion SFC programs run are shown below.

(1) When the CPU is powered off or reset operation is performed, Motion SFC programs stop to execute.

(2) At CPU power-off or key-reset, the contents of the motion registers #0 to #7999 are held. Initialize them in the Motion SFC programs as required.

(3) After CPU power-on or reset processing, Motion SFC programs run is shown below.

- The SFC programs set to start automatically are run from the beginning by turning PLC ready flag (M2000) on in the PLC program.
- The other Motion SFC programs are also executed from the first at starting.

11.11 Operation Performed when CPU is Switched from RUN/STOP

When a RUN/STOP switch is operated, PLC ready flag (M2000) turns on/off in accordance with "Operation at STOP to RUN" of a setting of a basic systems.
Refer to Section "1.5.3 Individual parameters" for the details of "Operation at STOP to RUN".
And, refer to the next section for PLC ready flag (M2000) off/on.

11.12 Operation Performed when PLC Ready flag (M2000) Turns OFF/ON

This section explains about the turns off/on of PLC ready flag (M2000).
The on/off condition of PLC ready flag (M2000) differences in "Operation at STOP to RUN" of a setting of a basic systems.
Refer to Section "1.5.3 Individual parameters" for details.

[M2000 OFF → ON]

If there is no fault when PLC ready flag (M2000) turns off to on, the PCPU ready flag (M9074) turns on.
When this PCPU ready flag (M9074) turns on, Motion SFC programs can be executed.
An automatic start Motion SFC program starts execution from the first.

[M2000 ON → OFF]

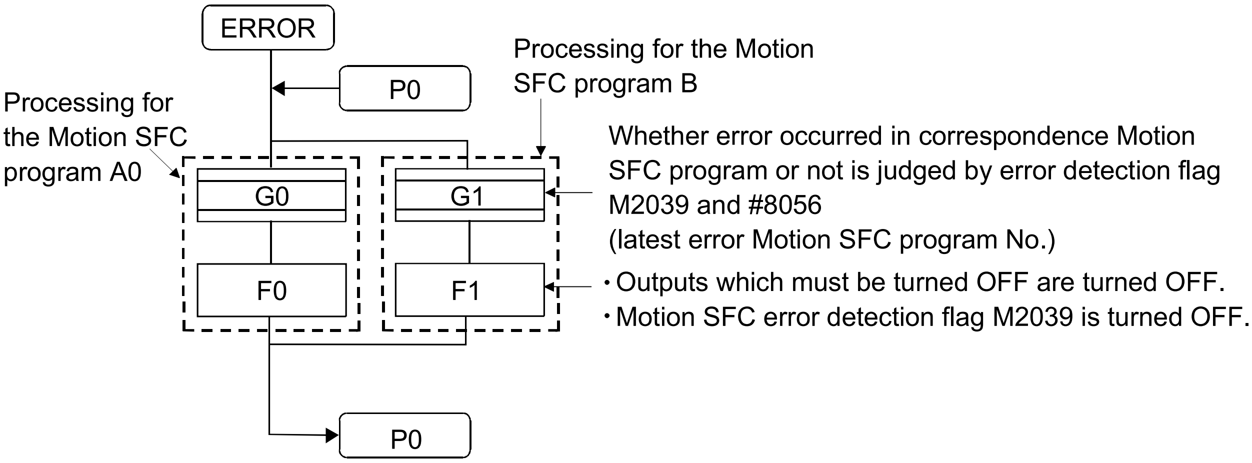
When PLC ready flag (M2000) turns off, Motion SFC programs stops to execute and the PCPU ready flag (M9074) turns off.
Since actual outputs PY has whole point turn off.

POINT

When the PLC ready flag (M2000) turns off, Motion SFC programs stop but actual outputs PY in the Motion SFC programs do not turn off.

11.13 Operation at The Error Occurrence

Outputs are held if Motion SFC programs stop due to error occurrence.
To turn off outputs at error occurrence, executes the following Motion SFC program.


ERROR
P0
G0
G1
F0
F1
P0
Processing for the Motion SFC program A0
Processing for the Motion SFC program B
Whether error occurred in correspondence Motion SFC program or not is judged by error detection flag M2039 and #8056 (latest error Motion SFC program No.)
・Outputs which must be turned OFF are turned OFF.
・Motion SFC error detection flag M2039 is turned OFF.

12. USER FILES

A user file list and directory structure are shown below

12.1 Projects

User files are managed on a "project" basis.
When you set a "project name", a "project name" folder is created as indicated on the next page, and under that, sub folders (Sfc, Glist, Gcode, Flist, Fcode) classified by file types are created.
Also, under the Sfc sub folders, initial files of the "project file (project name.prj)" and an editing folder (temp) are created.

POINT

- Set the "project name" on the project management screen.
- The "project name" is restricted to 230 characters in length.
- The "project path name" + "project name" are restricted to 230 characters in length.
  ((Example) "C:\Usr\.........\project name\")

12.2 User File List

A user file list is shown below.

(∗): Indicates the file(data) stored in CPU memory.

Project name folder ··· Folder of user-set "project name"

Sub folders (fixed)

Sfc					
	(1)	Project file	Project name.prj	(×1pc.) ··· Information file of correspondence between Motion SFC program No. (0 to 255) and SFC program names (SFC files)	
	(2)	Motion SFC chart file	SFC program name.sfc	(×256 pcs.) ··· Motion SFC chart edit information and comment information file of one Motion SFC program	
	(3)	Motion SFC list file	SFC program name.txt	(×256 pcs.) ··· Text file after conversion of Motion SFC chart of one Motion SFC program into list	
	(4)	Motion SFC code file	SFC program name.cod	(×256 pcs.) ··· File after conversion of list file of one Motion SFC program into internal codes (including comment information)	
Glist	(5)	G list file	g0000.bin to g4095.bin	··· LIst file of transition programs (G0 to G4095)	
Gcode	(6)	G code file	g0000.cod to g4095.cod	··· File after conversion of transition program(G0 to G4095) list file gn.bin(0≦n≦4095) into internal codes	
Flist	(7)	F/FS list file	f0000.bin to f4095.bin	··· List file of operation control programs (F/FS0 to F/FS4095) list file	
Fcode	(8)	F/FS code file	f0000.cod to f4095.cod	··· File after conversion of operation control program(F/FS0 to F/FS4095) list file fn.bin(0≦n≦4095) into internal codes	
(∗)	(9a)	Motion SFC program conversion file(control code)	sfcprog.cod	··· File where SFC code, G-code and F/FS code files are combined and converted into CPU's Motion SFC program code memory storage format	
(∗)	(9b)	Motion SFC program conversion file(text)	sfcprog.bin	··· File where G list and F/FS list files are combined and converted into CPU's Motion SFC program text memory storage format (Note-2) : The above two files are always updated simultaneously.	
(∗)	(10)	Motion SFC parameter file	sfcprm.bin	··· Motion SFC control parameter setting information files	
(∗)	(11)	K code file	svprog.bin	··· Internal code files of servo program (K0 to K4095) (file size is fixed length)	
	(12)	Automatic numbering setting information file	autono.inf	··· Automatic numbering setting information files	
	(13)	PC type file	gsvp.cnf	··· CPU type information files	
(∗)	(14)	System setting data file	svsystem.bin	··· System setting data information files	
		High speed read setting file	svlatch.bin	··· High speed read setting information files	
(∗)	(15)	Servo data file	svdata.bin	··· Servo parameter information files 1	
			svdata2.bin	··· Servo parameter information files 2	
			svls.bin	··· Limit switch setting data information files	
	(16)	Mechanical system program editing file (Note-1) : 32-axes only	svedtda1.bin	··· Mechanical system program edit information files (page 1 to 8)	SV22 only
			svedtda2.bin (Note-1)	··· Mechanical system program edit information files (page 9 to 16)	
			svedtda3.bin (Note-1)	··· Mechanical system program edit information files (page 17 to 24)	
			svedtda4.bin (Note-1)	··· Mechanical system program edit information files (page 25 to 32)	
(∗)	(17)	Mechanical system program conversion file	svmchprm.bin	··· File after conversion of mechanical system program edit information file svedtdan.bin into internal codes	
(∗)	(18)	Cam data conversion file (Note-1) : 32-axes only	svcamprm.bin	··· Cam data files of cam No.1 to 64	
			svcampr2.bin (Note-1)	··· Cam data files of cam No.101 to 164	
			svcampr3.bin (Note-1)	··· Cam data files of cam No.201 to 264	
			svcampr4.bin (Note-1)	··· Cam data files of cam No.301 to 364	
	(19)	Backup data file	svbackup.bin	··· Information file 1 for backup and load	
			svbackup2.bin	··· Information file 2 for backup and load	
			svbackup6.bin	··· Information file 6 for backup and load	
	(20)	Motion register file	modevice.bin	··· Motion register (#0 to #8191) reading file Only user device range(#0 to #7999) is written.	
		Device memory file	devmem.bin	··· Devices (X,Y, M/L, B, F, D, W, Special relay, Special register) except # reading file	
	(21)	Device setting screen information file	devset.inf	··· Device setting information file of device setting screen	
	(22)	PLC of the Q series common parameter file	param.wpa	··· Data files of Multiple CPU setting, I/O assignment etc.	
	(23)	Communication setting information file	communi.inf	··· Communication setting information files	
temp				··· Program editing temporary directory	

12.3 Online Change in The Motion SFC Program

The online change is used to write to the Motion SFC program to the internal SRAM during the positioning control (M.RUN LED: ON).
Program correction and a check of operation can be executed repeatedly at the Multiple CPU system start.

Data in which online change is possible are shown below.

Applicable data		Online change	Remarks
System setting data	System setting	×	
	Servo setting data	×	
Motion SFC program	Motion SFC parameter	×	
	Motion SFC chart	○	Online change is possible for the only program during stop.
	Operation control step (F/FS)	○	
	Transition (G)	○	
	Servo program (K)	○	Online change of mode assignment setting is not possible.
Mechanical system program (SV22 only)		×	
Cam data (SV22 only)		×	

○ : Possible × : Not possible

POINT

(1) Program writing is executed during the positioning control in the online change. Be safely careful enough for work.
(2) Programs writing to the internal SRAM of Motion CPU at the mode operated by ROM in the online change. If the online change is executed at the mode operated by ROM, it returns to the contents of program written in the internal FLASH ROM by the next power ON or resetting.
(3) If the online change is executed simultaneously to one Motion CPU from the multiple personal computers, a program writing may not be executed. Please do not perform.
(4) If the online changes are executed by other personal computer during the following operation by SW6RN-GSV□P, injustice of a monitor value and operation failure may occur. Please do not perform.
    - Monitor mode of the Motion SFC program • Test mode
    - Debug mode of the Motion SFC program
(5) If the online change of Motion SFC chart added newly is executed, since the online change of Motion SFC parameter cannot be executed, it operates as the normal task (default value).
(6) When using the SV22, if the online change is executed by changing the "program/servo program editor screen – [Mode assignment setting]", the contents of change are not reflected.
(7) If the cables between the peripheral devices and Motion CPU fall out, or the power supply of the Motion CPU turns OFF or resets, the program is corrupted. Write the program again with the communication screen of SW6RN-GSV□P.

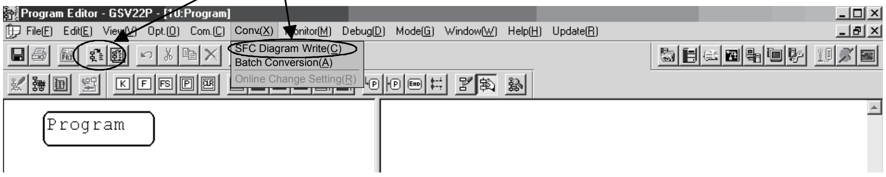
12.3.1 Operating method for The Online Change

Select the "Online change OFF/ON" of Motion SFC program with the "program editor screen [Convert] menu – [Online change setting]" of SW6RN-GSV☐P.
There are following three methods for the online change of Motion SFC program.

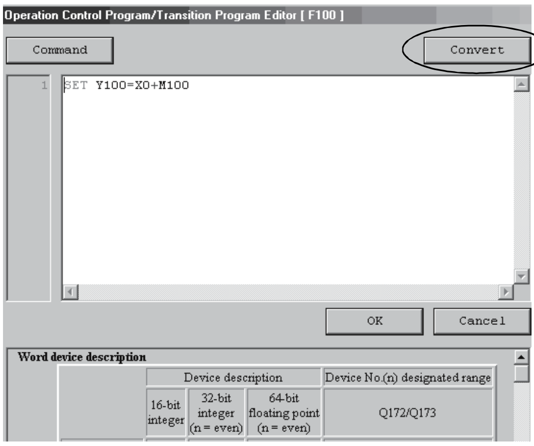
- When the program editor screen [SFC diagram write] is used ---- Online change of the Motion SFC program
- When the operation control/transition program editor screen [Convert] is used ---- Online change of the operation control/transition program editor screen
- When the servo program editor screen [Store] is used ---- Online change of the servo program

(1) When the program editor screen [SFC diagram write] is used.
Online change of the Motion SFC program during edit is executed by selecting the [SFC diagram write] key.
Online change is possible to the Motion SFC program during stop.
If the online change is made to the program during execution, an alarm message indicates. (Execution/stop state of the Motion SFC program can be checked with the program batch monitor.)
If the start request is made to the program during online change, the Motion SFC start error (error code16007: online change) will occur and the program does not start.

• [SFC Diagram Write] Key



(2) When the operation control/transition program editor screen [Convert] is used.
Online change of the operation control/transition program during edit is executed by selecting the [Convert] key.
Online change is possible to the operation control/transition program during execution.
A program that the online change was made is executed from the next scan.


Operation Control Program/Transition Program Editor [F100]
Command
Convert
OK
Cancel

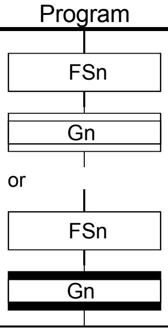
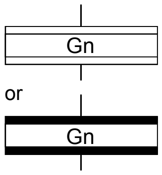
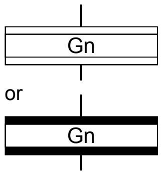
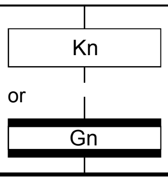
```
SET Y100=X0+M100
```

Word device description

	Device description			Device No.(n) designated range
	16-bit integer	32-bit integer (n = even)	64-bit floating point (n = even)	Q172/Q173

• [Convert] Key

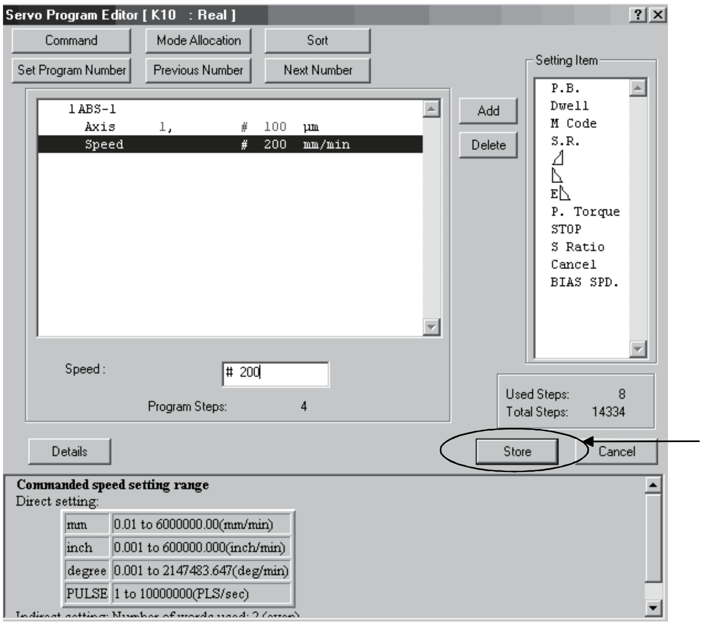
Operations for which made the online change to the operation control/transition program during execution in the following conditions are shown below. Be careful to execute the online change in the following conditions.

Program	Condition	Operation
	• Online change of the FSn operation control program is executed during FSn execution in the state of waiting for the completion of condition for Gn.	• After completion of online change, the FSn repeats the operation control program that the online change was made until the completion of condition for Gn.
	• Online change of the Gn program is executed in the state of waiting for the completion of condition for Gn. (The conditional sentences of program to write are except the TIME instruction.)	• After completion of online change, the Gn does not transit to the next step until the completion of condition for program that the online change was made.
	• Online change of the Gn program including the TIME instruction is executed in the state of waiting for the completion of condition for Gn.	• After completion of online change, Gn is ended regardless of the waiting time of TIME instruction and the next step is executed.
	• Online change of the Gn program during the servo program execution for Kn.	• After execution of servo program, the program of changed Gn is executed.

(3) When the servo program editor screen [Store] is used.

Online change of the servo program during edit is executed by selecting the [Store] key.

Online change is possible to the servo program during execution.
A program that the online change was made is executed at the next servo program start.



```
1 ABS-1
  Axis      1,         #  100  μm
  Speed                #  200  mm/min
```

Speed : # 200

Program Steps: 4

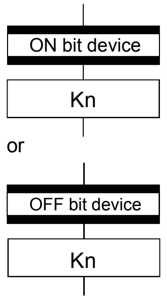
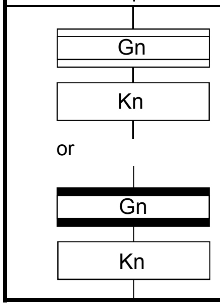
Used Steps: 8
Total Steps: 14334

Commanded speed setting range
Direct setting:

mm	0.01 to 6000000.00(mm/min)
inch	0.001 to 600000.000(inch/min)
degree	0.001 to 2147483.647(deg/min)
PULSE	1 to 10000000(PLS/sec)

• [Store] Key

Operations for which made the online change to the servo program in the following conditions during execution are shown below. Be careful to execute the online change in the following conditions.

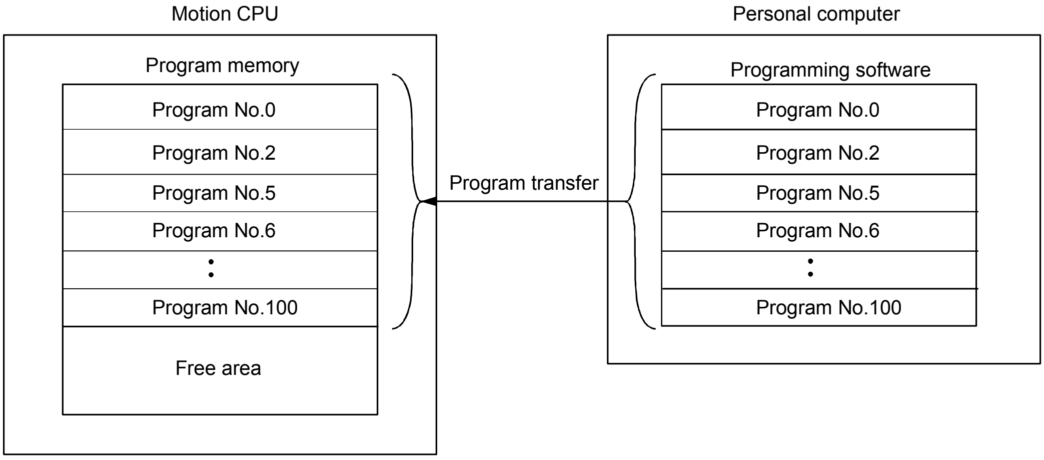
Program	Condition	Operation
	• Online change of the servo program Kn at the WAITON or after WAITOFF is executed in the state of waiting for the completion of condition for WAITON/WAITOFF.	• After completion of condition for WAITON/WAITOFF, the servo program before the online change is started. • The servo program that the online change was made is executed at the next servo program start.
	• Online change of the servo program Kn after Gn is executed in the state of waiting for the completion of condition for Gn.	• After completion of condition for Gn, the servo program that online change was made is executed.

12.3.2 Transfer of program

The outline operations to transfer the program from SW6RN-GSV□P to the program memory of Motion CPU are described.

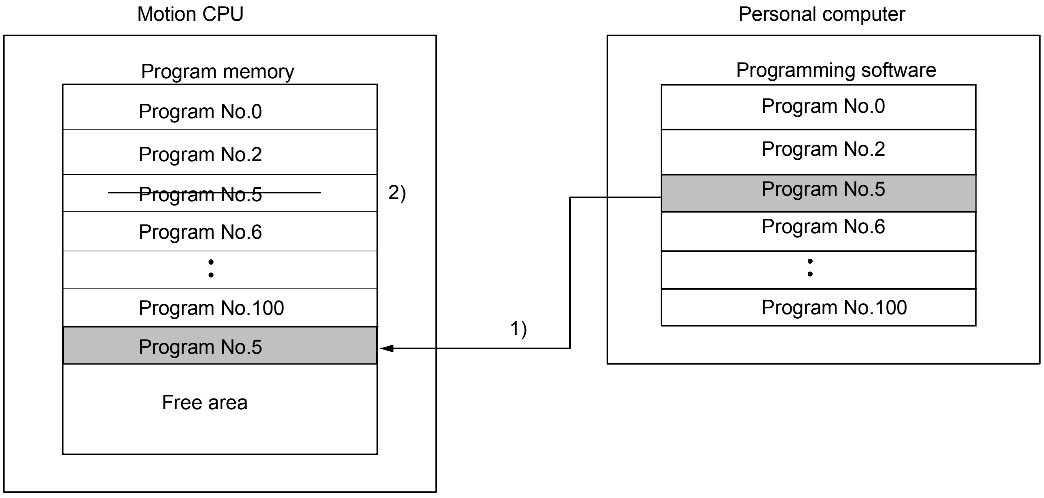
(1) Program writing by the [Communication] menu - [Transfer]

(a) After transfer, programs are stored in the program memory of Motion CPU stuffing to the front for every kind.

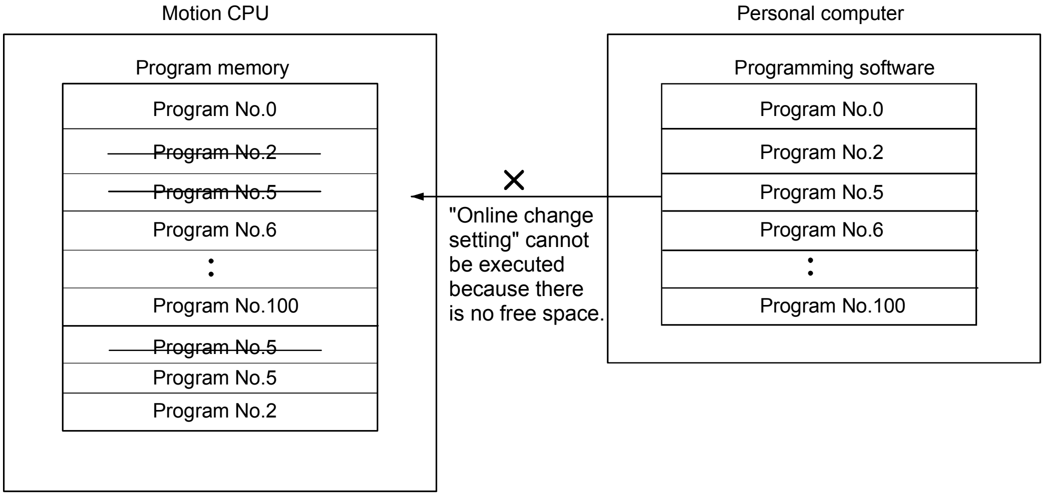


(2) Program writing by the [Online change]

(a) After online change, a program to execute the online change is stored in the free area after the program stored previously. (Refer to 1))
After that, the program written in previously is made invalid and the new program is made valid. (Refer to 2))



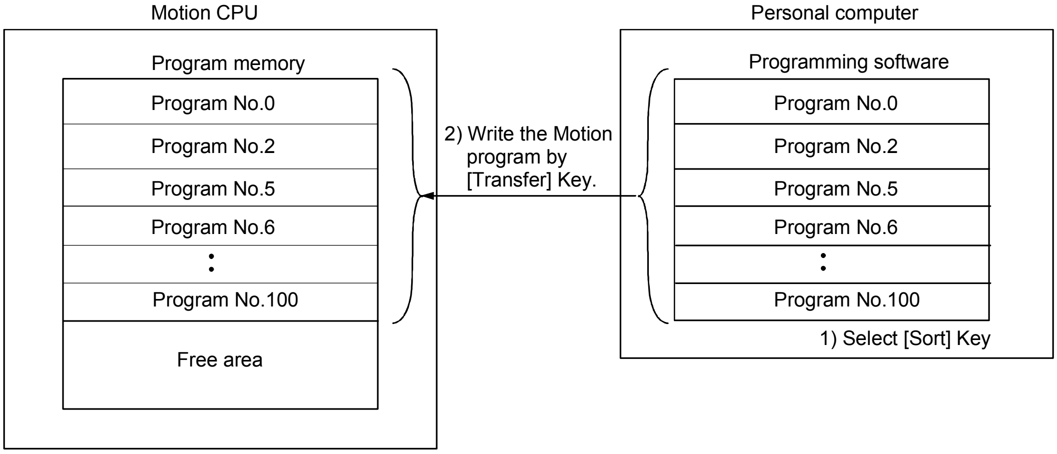
(b) If the online change is executed repeatedly, the free space in program memory is lost and the online change may not be executed. In this case, an error message is displayed by SW6RN-GSV□P at the online change, and "Online change OFF" is set.



(c) In the case of b), arrange to stuff to the front the invalid programs. Operation procedures to stuff to the front are shown below.

1) Select the "program editor screen [Option] menu – [Sort]" of SW6RN-GSV□P. In this case, the invalid programs in the personal computer arranges by SW6RN-GSV□P.

2) Execute the program writing with the [Communication] menu – [Transfer] in the stop state of Motion CPU.



13. LIMIT SWITCH OUTPUT FUNCTION

This function is used to output the ON/OFF signal corresponding to the data range of the watch data set per output device.
Motion control data or optional word data can be used as watch data. (Refer to Section "13.2 Limit Output Setting Data" for details.) A maximum output device for 32 points can be set regardless of the number of axes.

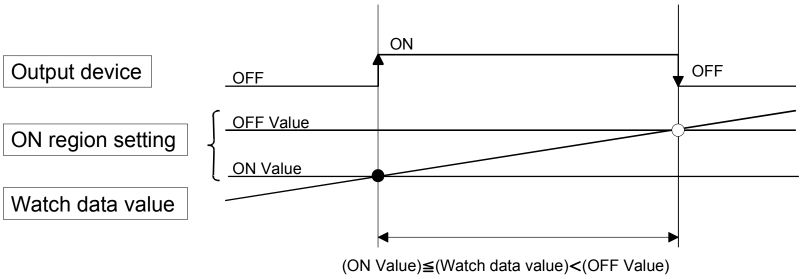
13.1 Operations

(1) ON output to an output device is made while the watch data value is in the ON output region set with (ON Value) and (OFF Value) in this function.

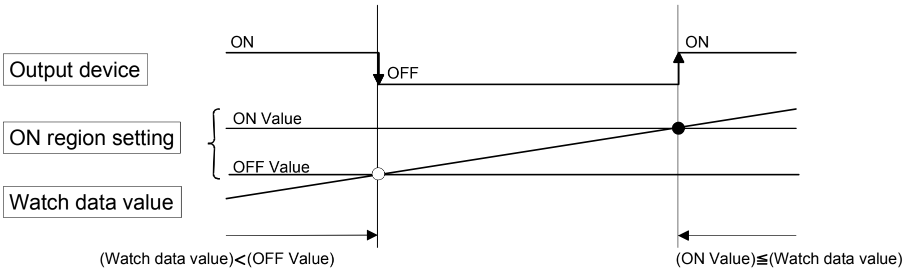
(a) (ON Value), (OFF Value) and watch data value are handled as signed data. ON output region where an ON output is made to the output device is governed by the magnitude relationship between (ON Value) and (OFF Value) as indicated below.

Relationship between (ON Value) and (OFF Value)	ON output region
(ON Value) < (OFF Value)	(ON Value) <= (watch data value) < (OFF Value)
(ON Value) > (OFF Value)	(ON Value) <= (watch data value) (Watch data value) < (OFF Value)
(ON Value) = (OFF Value)	Output OFF in whole region

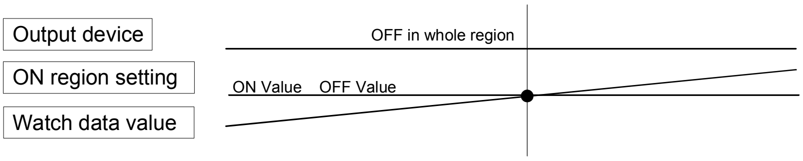
1) (ON Value) < (OFF Value)



2) (ON Value) > (OFF Value)

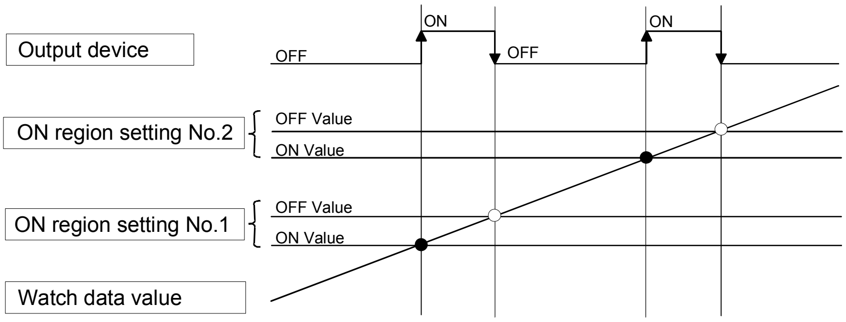


3) (ON Value) = (OFF Value)



(b) The limit switch outputs are controlled based on the each watch data during the PCPU ready status (M9074: ON) by the PLC ready flag (M2000) from OFF to ON.
When the PCPU ready flag (M9074) turns OFF by turning the PLC ready flag (M2000) from ON to OFF, all points turn OFF. When (ON Value) and (OFF Value) are specified with word devices, the word device contents are input to the internal area when the PLC ready flag (M2000) turns from OFF to ON. After that, the word device contents are input per motion operation cycle, and limit switch outputs are controlled.

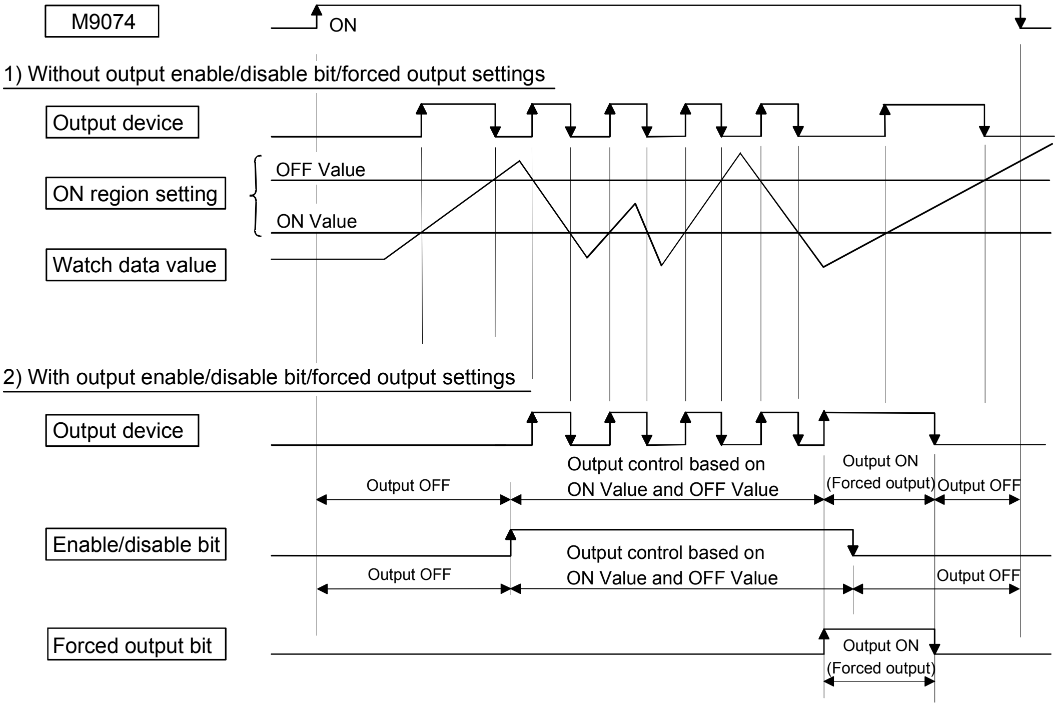
(c) Multiple outputs (Up to 32 points) can be also set to one watch data. In each setting, the output device may be the same.
If multiple ON region settings have been made to the same output device, the logical add of the output results in the regions is output.



(2) Output enable/disable bit can be set and executed enable/disable of the limit switch outputs point-by-point.
Limit switch output control is executed when the output enable/disable bit is ON, and the output is OFF when it is OFF.
If there is no setting, the outputs are always enabled.

(3) Forced output bit can be set and turned the forcibly output of the limit switch outputs point-by-point ON.
The output is ON when the forced output bit is ON. Priority is given to control of this setting over off (disable) of the "output enable/disable bit".
If there is no setting, no forced outputs are not always made.

(4) When the multiple watch data, ON region, output enable/disable bit and forced output bit are set to the same output device, the logical add of output results of the settings is output.


M9074
ON
1) Without output enable/disable bit/forced output settings
Output device
ON region setting
OFF Value
ON Value
Watch data value
2) With output enable/disable bit/forced output settings
Output device
Output OFF
Output control based on ON Value and OFF Value
Output ON (Forced output)
Output OFF
Enable/disable bit
Output OFF
Output control based on ON Value and OFF Value
Output OFF
Forced output bit
Output ON (Forced output)

13.2 Limit Output Setting Data

Limit output data list are shown below.
Up to 32 points of output devices can be set.
(The following items of No.1 to No.5 are set together as one point.)

No.	Item		Setting range	Fetch cycle	Refresh cycle	Remarks
1	Output device		Bit device (X, Y, M, L, B)	—	Operation cycle	
2	Watch data		Motion control data/ word device (D, W, #, absolute address) (16-bit integer type/32-bit integer type/ 64-bit floating-point type)	Operation cycle	—	
3	ON region setting	ON Value	Word device (D, W, #)/constant (K, H)			
		OFF Value	Word device (D, W, #)/constant (K, H)			
4	Output enable/disable bit		Bit device (X, Y, M, L, B, F, special relay)/ none (default)			ON : Enable OFF : Disable None : Always enable
5	Forced output bit		Bit device (X, Y, M, L, B, F, special relay)/ none (default)			None : No forced outputs are always made (OFF status)

(1) Output device

(a) Set the bit device which outputs the ON/OFF signal toward the preset watch data.

(b) As the output device, the following devices can be used.

Item	Device No. setting range
Input relay (Note-1)	X0 to X1FFF
Output relay (Note-2)	Y0 to Y1FFF
Internal relay (Note-3)	M0 to M8191
Latch relay	L0 to L8191
Link relay	B0 to B1FFF

(Note-1) : PX is write-disabled and it cannot be used as the output device.
For X, only the free No. of the input card non-loading can be used.

(Note-2) : The real output device range (PY) is also included.

(Note-3) : M2001 to M2032 cannot be used to the output device.
Be careful because it affect a positioning operation, when the positioning dedicated devices are set.

(2) Watch data

(a) This data is used to perform the limit switch output function. This data is comparison data to output the ON/OFF signal. The output device is ON/OFF-controlled according to the ON region setting.

(b) As the watch data, motion control data or optional word device data can be used.

1) Motion control data

Item	Unit	Data type	Axis No. setting range	
			Q173CPU(N)	Q172CPU(N)
Feed current value	Position command	32-bit integer type	1 to 32	1 to 8
Real current value				
Deviation counter value	PLS			
Motor current (Command output voltage : ACF)	0.1% (0.01V)	16-bit integer type		
Motor speed	0.1r/min	32-bit integer type		
Cam shaft within-one-revolution current value	PLS			
Feed current value (Virtual)				
After-differential current value (Virtual)				
After-differential encoder current value			1 to 12	1 to 8
Encoder current value				

2) Word device data

Item	Device No. setting range
Data register	D0 to D8191
Link register	W0 to W1FFF
Motion register	#0 to #8191

3) When the optional device data is set, the following data type is set as the data type to be compared.

Data type	Device No. setting range
16-bit integer type	Set the device No. as an even No..
32-bit integer type	
64-bit floating-point type	

(3) ON region setting

(a) The data range which makes the output device turn ON/OFF toward the watch data.

(b) The following devices can be used as the ON Value and OFF Value of the data range.
The data type of device/constant to be set is the same as the type of watch data.

Item	Device No. setting range
Data register	D0 to D8191
Link register	W0 to W1FFF
Motion register	#0 to #8191
Constant	Hn/Kn

(4) Output enable/disable bit

(a) Set the status of output enable/disable bit when the limit switch output is forbidden during operation.

1) The following control is exercised.

Output enable/disable bit		Control description
Without setting (always enable)		Limit switch output is turned ON/OFF based on the ON region setting (ON Value, OFF Value).
With setting	ON (enable)	
	OFF (disable)	Limit switch output is turned OFF.

(b) Usable devices

Item	Device No. setting range
Input relay (Note-1)	X0 to X1FFF
Output relay (Note-2)	Y0 to Y1FFF
Internal relay	M0 to M8191
Latch relay	L0 to L8191
Link relay	B0 to B1FFF
Annunciator	F0 to F2047
Special relay	M9000 to M9255

(Note-1) : The real input range(PX) is included.

(Note-2) : The real input range(PY) is included.

(5) Forced output bit

(a) Set the "forced output bit" when you want to forcibly provide the limit switch outputs during operation.

1) The following control is exercised.

Forced output bit		Control description
Without setting		Limit switch outputs are turned ON/OFF on the basis of the "output enable/disable bit" and ON region setting (ON Value, OFF Value).
With setting	OFF	
	ON	Limit switch outputs are turned ON.

(b) Usable devices

Item	Device No. setting range
Input relay	X0 to X1FFF
Output relay	Y0 to Y1FFF
Internal relay	M0 to M8191
Latch relay	L0 to L8191
Link relay	B0 to B1FFF
Annunciator	F0 to F2047
Special relay	M9000 to M9255

MEMO

14. ROM OPERATION FUNCTION

Refer to Section 1.3.4 for the correspondence version of the Motion CPU and the software.

This function is used to store beforehand the user programs and parameters in the internal FLASH ROM memory built-in the Motion CPU module, and operate it based on the data of internal FLASH ROM memory.

14.1 About the ROM Operation Function

The outline procedure of ROM operation function is shown below.

(1) Turn on or reset the power supply of Multiple CPU system in the "Mode operated by RAM".

(2) Execute a trial run and adjustment by creating the system setting, programs and parameters using SW6RN-GSV□P.

(3) Turn on or reset the power supply of Multiple CPU system in the "Installation mode • mode written in ROM".

(4) Write the system setting, programs and parameters of SRAM built-in the Motion CPU module to the internal FLASH ROM by performing the ROM writing request using SW6RN-GSV□P.

(5) Start a normal operation by starting the Motion CPU in the "Mode operated by ROM" after reading the system setting, programs and parameters written in the internal FLASH ROM to the internal SRAM.

POINT

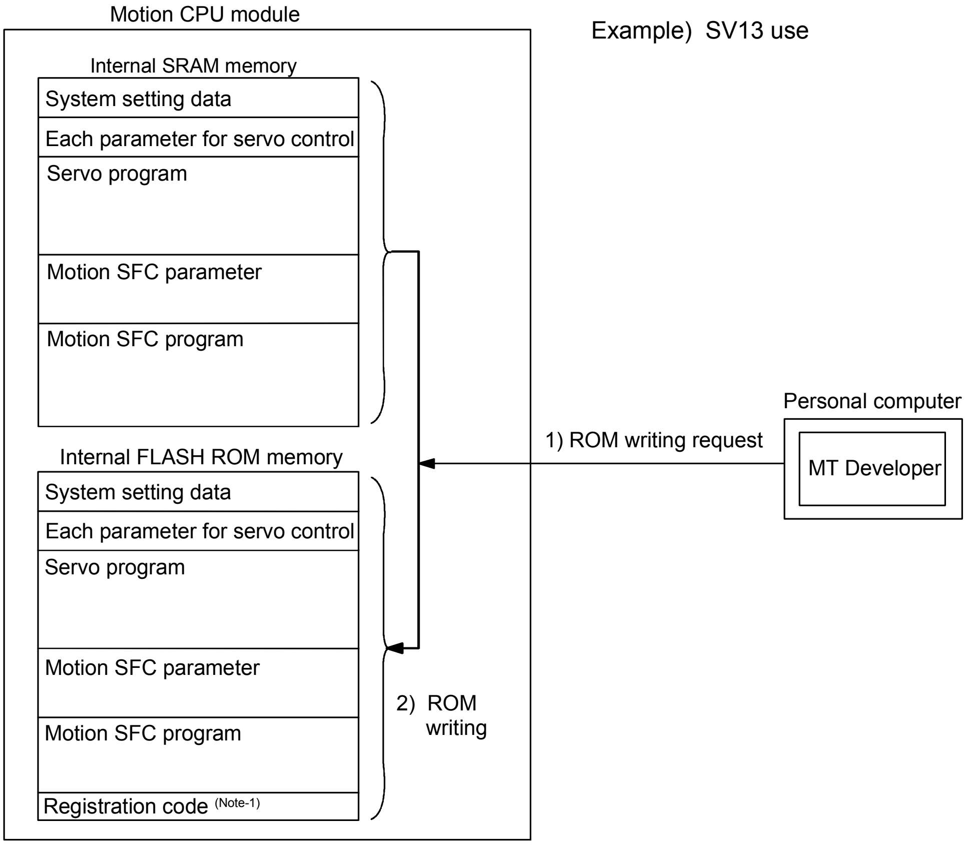
(1) Switch the operation mode using a DIP switches of Motion CPU module.

(2) Confirm the operation mode with "Mode LED" and "BOOT LED" of Motion CPU module.

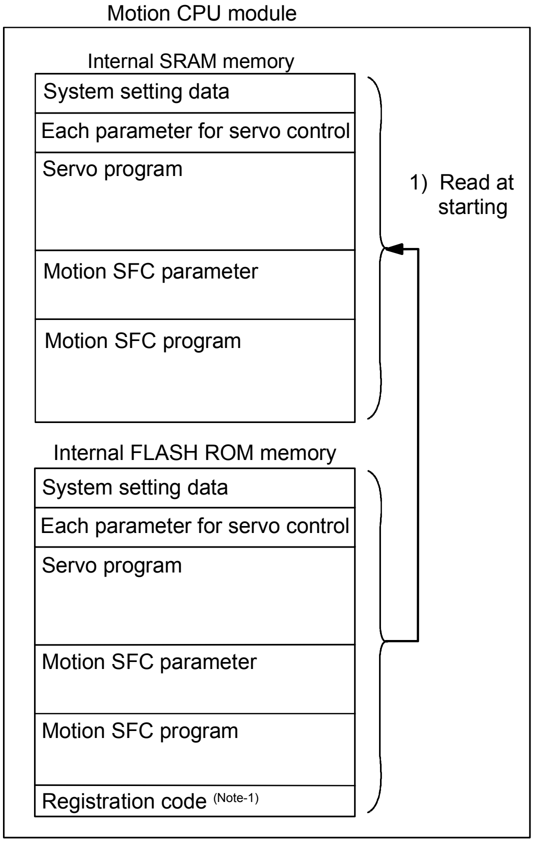
Outline of processing is shown next page.

• Installation mode• mode written in ROM

Example) SV13 use



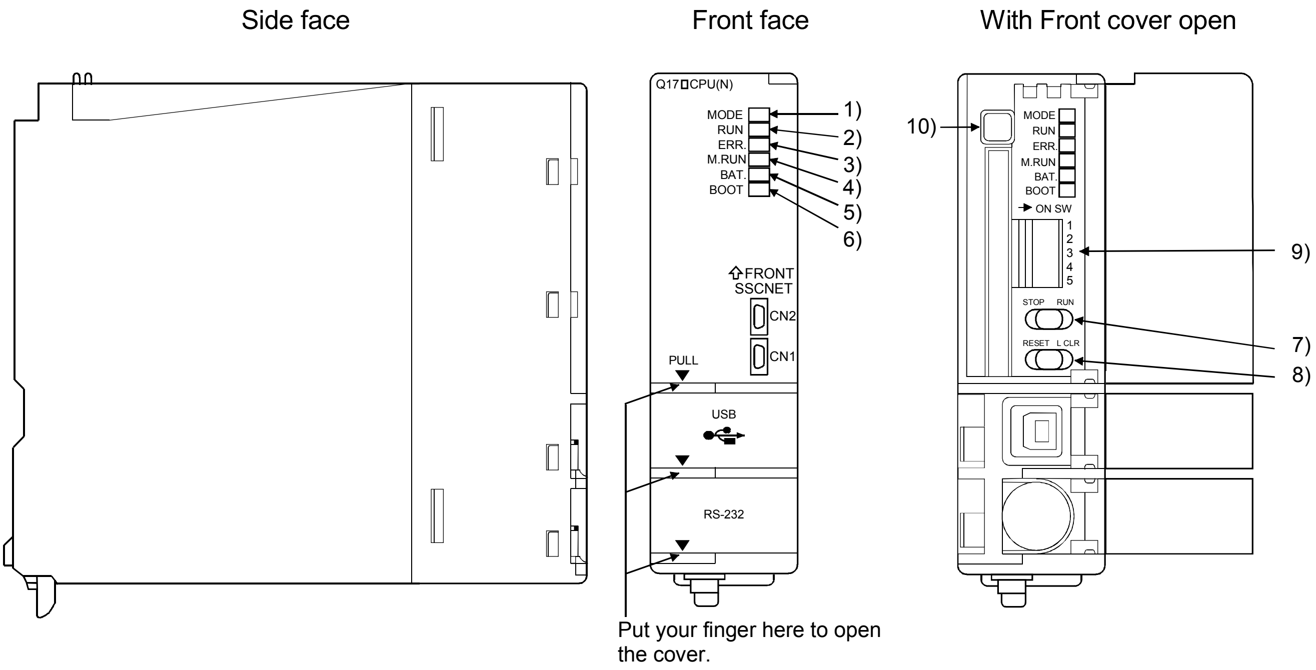
• Mode operated by ROM



(Note-1): "Registration code" is used to judge whether the programs and parameters written in the internal FLASH ROM are normal or not.

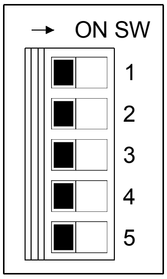
14.2 Specifications of LED • Switch

(1) Name of parts



No.	Name	Application
1)	MODE LED(Mode judging)	• Lit(green) : Normal mode • Lit(orange) : Installation mode • mode written in ROM
2)	RUN LED	• Lit : Motion CPU normal start • Not lit : Motion CPU fault LED turns off when the trouble occurred at Motion CPU start or WDT error occurred.
3)	ERR. LED	• Lit : LED turns on at following errors occurrence. 1) WDT error 2) System setting error 3) Servo error 4) Self diagnostic error which will not stop the operation (except battery error). 5) Operating system software is not installed. • Flickers : Detection of self diagnostic error which will stop the operation. • Not lit : Normal
4)	M.RUN LED	• Lit : During motion control • Flickers : Latch clear start • Not lit : Not during motion control or detection of self diagnostic error which will stop the operation.
5)	BAT. LED	• Lit : Battery error occurrence (External battery use)
6)	BOOT LED	• Lit : Mode operated by ROM • Not lit : Mode operated by RAM/Installation mode • mode written in ROM

(2) Applications of switches

No.	Name	Application	
7)	RUN/STOP switch	• Move to RUN/STOP. RUN : Motion SFC program is started. STOP : Motion SFC program is stopped.	
8)	RESET/L.CLR switch (Note-1) (Momentary switch)	RESET : Set the switch to the "RESET" position once to reset the hardware. Applies a reset after an operation error and initialized the operation. L.CLR : Clear the latch area all data which set with the parameters. (LATCH CLEAR also clears data outside the latch area at this time.) • Latch clear operating method 1) Set the "RUN/STOP" switch to "STOP". 2) Move the "RESET/L.CLR" switch to "L.CLR" several times until the "M.RUN LED" flickers. ("M.RUN LED" flickers : Latch clear completed.) 3) Move the "RESET/L.CLR" switch to "L.CLR" once more. ("M.RUN LED" turn off.)	
9)	Dip switches 	Dip switch 1	Must not be used. (Shipped from the factory in OFF position)
		Dip switch 2	ROM operating setting (Shipped from the factory in OFF position) SW2 SW3 OFF OFF → Mode operated by RAM ON OFF → Must not be set OFF ON → Must not be set ON ON → Mode operated by ROM
		Dip switch 3	
		Dip switch 4	Must not be used. (Shipped from the factory in OFF position)
		Dip switch 5 (Installation • ROM writing switch)	ON : Installation mode • mode written in ROM OFF : Normal mode (Mode operated by RAM / Mode operated by ROM) Turn ON dip switch 5 when installed the operating system software into the Motion CPU module from the peripheral device. After completing the installation, move to switch and re-start.
10)	Memory card EJECT button	Used to eject the memory card from the Motion CPU.	

(Note-1) : It is not possible to reset the Multiple CPU system by each of the PLC CPU/Motion CPU No.2 to 4.
If it is reset, other CPU occurred to stop of the overall Multiple CPU system where "MULTI CPU DOWN" (Error code: 7000).
The overall Multiple CPU system reset is resetting the CPU No.1 of PLC CPU.

14.3 ROM Operation Function Details

(1) Operation mode

"Operation mode" of CPU is set by the state of DIP switch 2, 3, 5 of Motion CPU module at the power supply on or reset of Multiple CPU system.

DIP switch setting, operation mode and operation mode overview are shown below.

(a) DIP switch setting and operation mode

Dip switch setting			Operation mode
SW2	SW3	SW5	
OFF	OFF	ON	Installation mode • mode written in ROM
OFF	ON	ON	Must not be set (Note-1)
ON	OFF	ON	Must not be set (Note-1)
ON	ON	ON	Installation mode • mode written in ROM
OFF	OFF	OFF	Mode operated by RAM
OFF	ON	OFF	Must not be set (Note-2)
ON	OFF	OFF	Must not be set (Note-2)
ON	ON	OFF	Mode operated by ROM

(Note-1) : It operates in the "Installation mode • mode written in ROM" for wrong setting.

(Note-2) : It operates in the "Mode operated by RAM" for wrong setting.

(b) Operation mode overview

Operation mode	Operation overview
Installation mode • mode written in ROM	• MODE LED turns on in orange. • BOOT LED turns off. • The operating system software can be installed. • The user programs and parameters for ROM operation can be written to the FLASH ROM built-in Motion CPU module. • ROM writing is executed at ROM operating after operation check in the RAM operating mode. The user programs and parameters stored in the SRAM built-in Motion CPU module are batch written to the FLASH ROM built-in Motion CPU module. • It becomes STOP state regardless of the RUN/STOP switch in front of Motion CPU module. • The digital oscilloscope function cannot be used.
Mode operated by RAM	• MODE LED turns on in green. • BOOT LED turns off. • Operation is executed based on the user programs and parameters stored in the SRAM built-in Motion CPU module.
Mode operated by ROM	• MODE LED turns on in green. • BOOT LED turns on. • Operation starts after reading the user programs and parameters stored in the internal FLASH ROM to the internal SRAM at power supply on or reset of Multiple CPU system. Even if the user programs and parameters are changed by SW6RN-GSV□P during ROM operating mode, it returns to the contents of internal FLASH ROM at next power supply on or system reset. Also, even if the auto tuning data are reflected on the servo parameter of Motion CPU by operating the servo amplifier with auto-tuning setting, it returns to the contents of internal FLASH ROM at next power supply on or reset release.

POINT

Even if a DIP switch setting is changed on the way after the power supply on, "Operation mode" is not changed. Be sure to turn on or reset the power supply of Multiple CPU system to change a DIP switch setting.

(2) Applicable data into ROM

The data contents batch written to the internal FLASH ROM by ROM writing are shown below. Backup data except the followings (current position of servomotor in absolute position system, home position and latch device, etc.) cannot be written to the internal FLASH ROM.

(a) Content of applicable data into ROM

SV13	SV22
System setting data	System setting data
Each parameter for servo control	Each parameter for servo control
Servo program	Servo program
Motion SFC parameter	Motion SFC parameter
Motion SFC program	Motion SFC program
—	Mechanical system program (Note-1)
—	Cam data (Note-1)

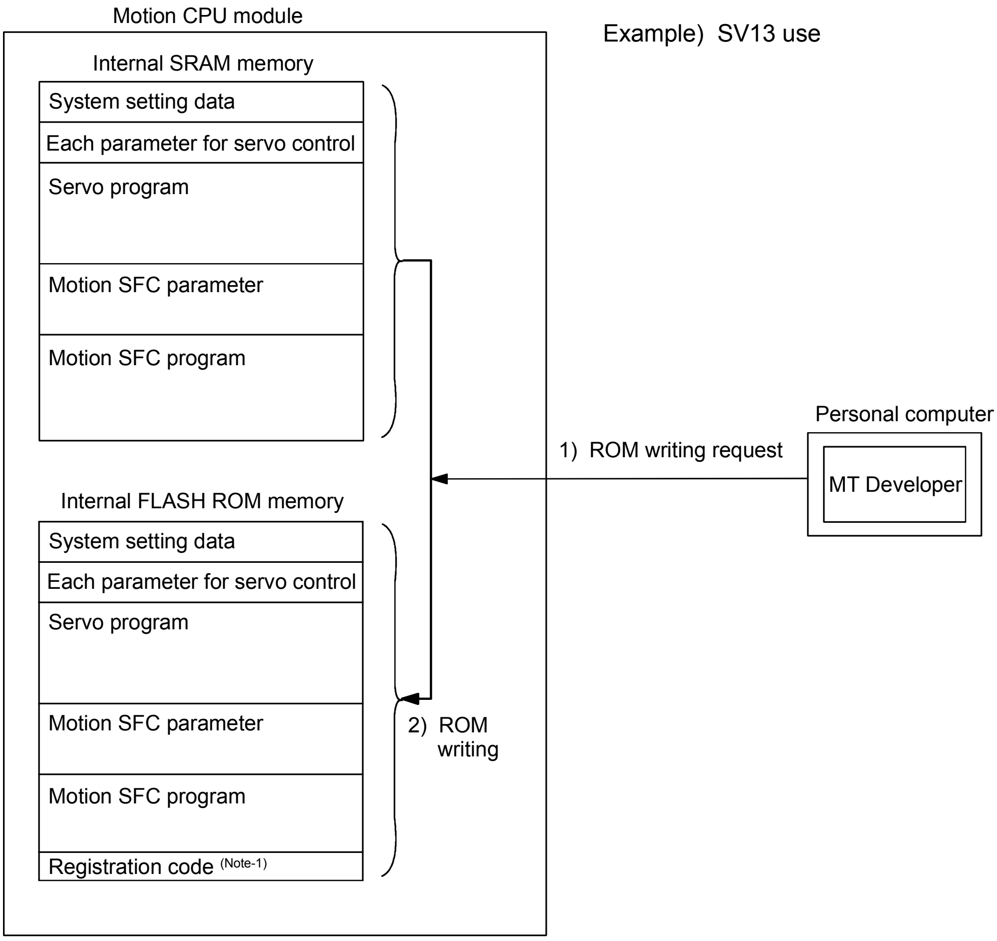
(Note-1) : Mechanical system program and cam data are "applicable data into ROM", when using the SV22.

(b) Operation at applicable data into ROM

When the ROM writing is requested to the Motion CPU module using "ROM writing" menu of SW6RN-GSV□P, the applicable data into ROM stored in the internal SRAM are batch-written to the internal FLASH ROM after erase of an user memory area of FLASH ROM built-in Motion CPU module.

When the writing completes normally, the registration code (Note-2) is written and ROM writing ends.

The process overview is shown below.



(Note-1) : "Registration codes" is used to judge whether the programs and parameters written in the internal FLASH ROM are normal or not.

POINT

(1) When the RAM is selected with "Communication" - "Transfer" menu of SW6RN-GSV□P, the SRAM memory built-in Motion CPU module is targeted at the "Installation mode • mode written in ROM" and "Mode operated by ROM".

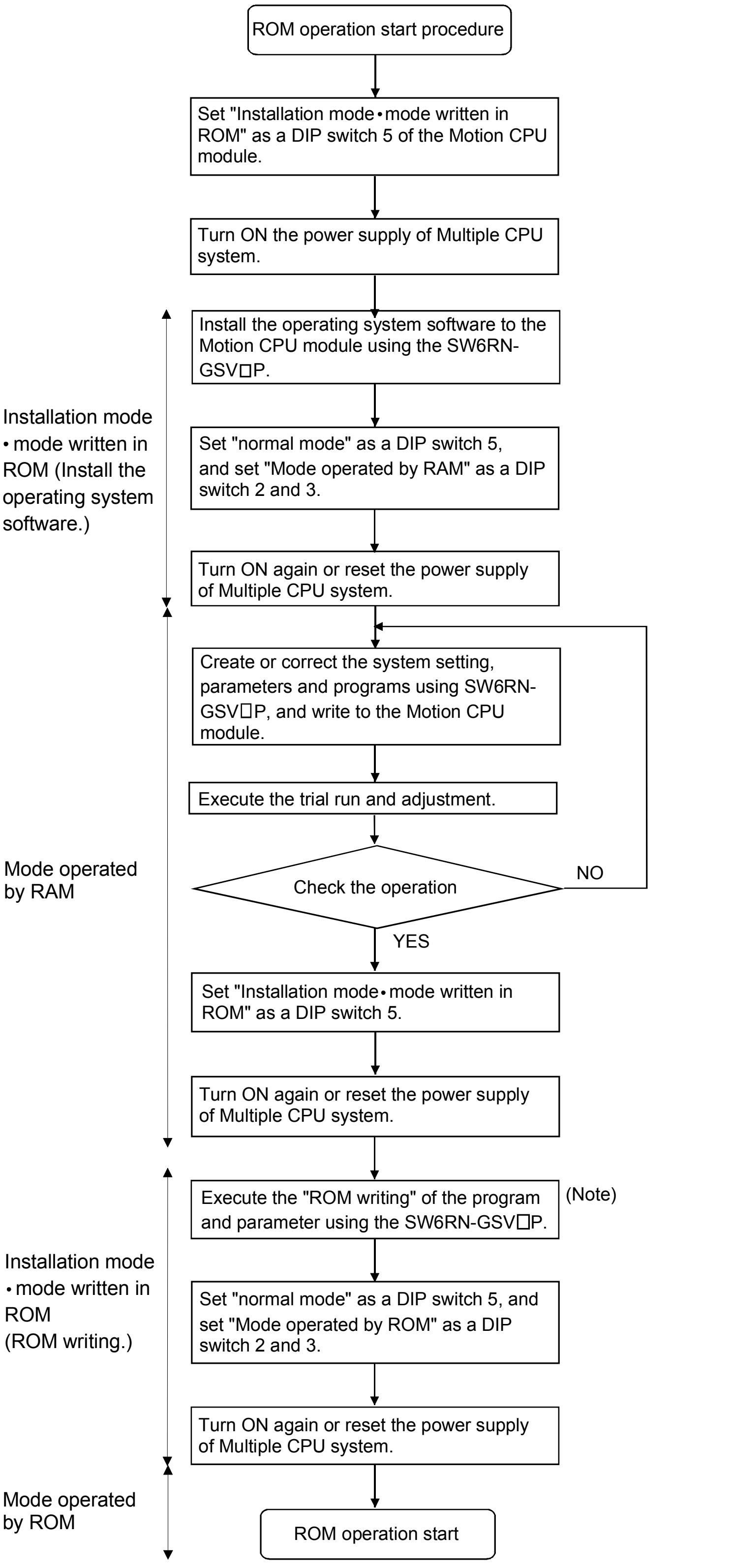
(2) The SRAM memory built-in Motion CPU module is targeted at the "Backup • load" operation of SW6RN-GSV□P. Set the "Mode operated by ROM" after "ROM writing" for the ROM operation after "Backup • load" at the CPU module replacement.

(3) The internal FLASH ROM serves as a life in 100000 times writing. If it passes over a life, "writing error" will occur. After that, replace a module at the ROM operation.

(4) The online change of Motion SFC program at the mode operated by ROM executes the Motion SFC program performed the online change from the next scanning. After that, it returns to the contents of Motion SFC program written in the internal FLASH ROM at the power supply on or system reset.

(3) ROM operation procedure

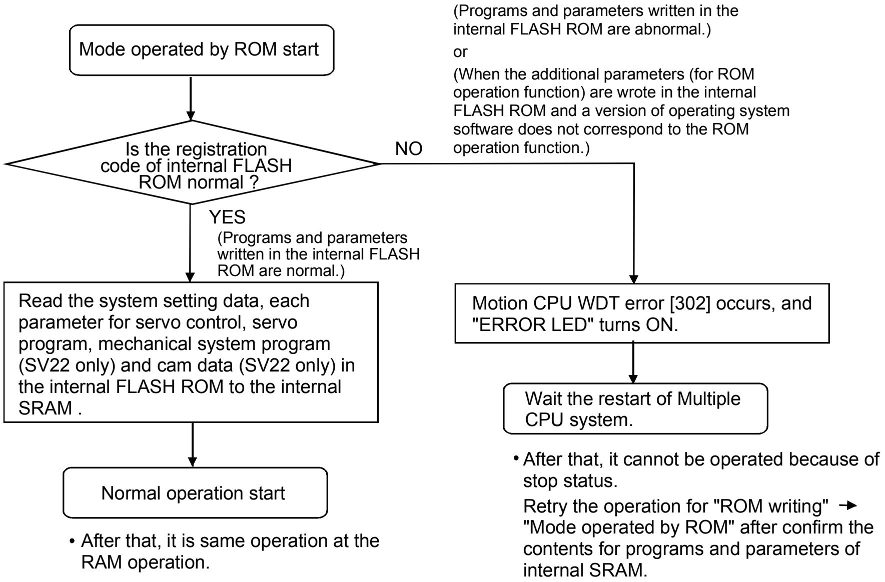
The flowchart to start the ROM operation is shown below.


ROM operation start procedure
Set "Installation mode • mode written in ROM" as a DIP switch 5 of the Motion CPU module.
Turn ON the power supply of Multiple CPU system.
Installation mode • mode written in ROM (Install the operating system software.)
Install the operating system software to the Motion CPU module using the SW6RN-GSV□P.
Set "normal mode" as a DIP switch 5, and set "Mode operated by RAM" as a DIP switch 2 and 3.
Turn ON again or reset the power supply of Multiple CPU system.
Mode operated by RAM
Create or correct the system setting, parameters and programs using SW6RN-GSV□P, and write to the Motion CPU module.
Execute the trial run and adjustment.
Check the operation
NO
YES
Set "Installation mode • mode written in ROM" as a DIP switch 5.
Turn ON again or reset the power supply of Multiple CPU system.
Installation mode • mode written in ROM (ROM writing.)
Execute the "ROM writing" of the program and parameter using the SW6RN-GSV□P.
(Note)
Set "normal mode" as a DIP switch 5, and set "Mode operated by ROM" as a DIP switch 2 and 3.
Turn ON again or reset the power supply of Multiple CPU system.
Mode operated by ROM
ROM operation start

(Note) : Do not execute the ROM writing for program and parameter while installing the operating system software.

(4) Operation at the "Mode operated by ROM"

Operation at the "Mode operated by ROM" is shown below.


(Programs and parameters written in the internal FLASH ROM are abnormal.)
or
(When the additional parameters (for ROM operation function) are wrote in the internal FLASH ROM and a version of operating system software does not correspond to the ROM operation function.)
Mode operated by ROM start
Is the registration code of internal FLASH ROM normal ?
NO
YES
(Programs and parameters written in the internal FLASH ROM are normal.)
Read the system setting data, each parameter for servo control, servo program, mechanical system program (SV22 only) and cam data (SV22 only) in the internal FLASH ROM to the internal SRAM .
Motion CPU WDT error [302] occurs, and "ERROR LED" turns ON.
Wait the restart of Multiple CPU system.
Normal operation start
• After that, it is same operation at the RAM operation.
• After that, it cannot be operated because of stop status.
Retry the operation for "ROM writing" → "Mode operated by ROM" after confirm the contents for programs and parameters of internal SRAM.

POINT

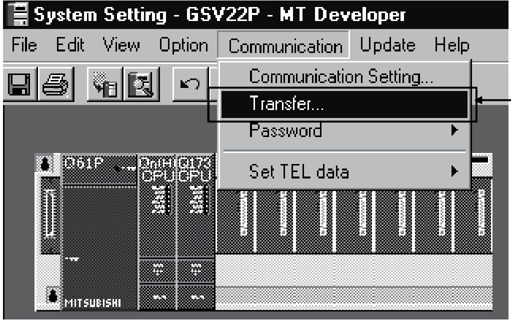
If the ROM operation of a data written in the internal FLASH ROM is executed in the combination of the Motion CPU module for additional parameter (ROM operation function) and programming software by the operating system software not for additional parameter (ROM operation function), a Motion CPU WDT error (error code: 302) will occur and the ROM operation cannot executed.

In this case, use the operating system software for additional parameter (ROM operation function). (Refer to Section 1.3.4.)

14.4 Operating Procedure of "ROM writing"

The operating procedure of ROM writing using the SW6RN-GSV□P is shown below.

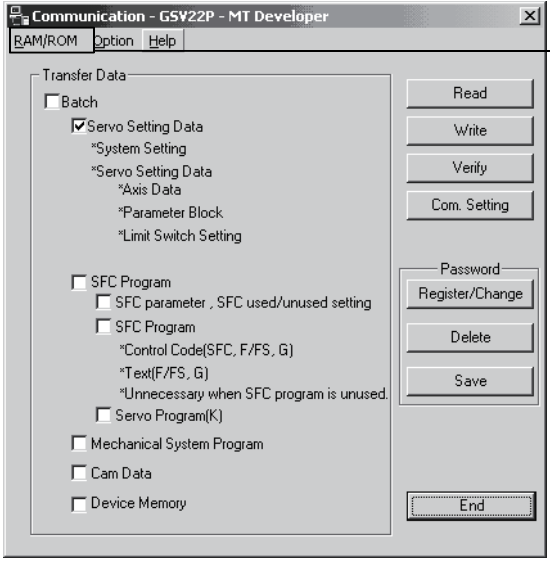
・System setting screen



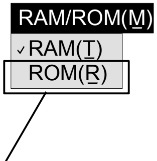
Operating procedure

1) Display "ROM/RAM" communication dialog screen after clicking on "Communication" - "Transfer" of the system setting menu screen.
(Note) : Select "Transfer" at the ROM writing.

・"When selecting the RAM." (Default screen at "Transfer" selecting.)

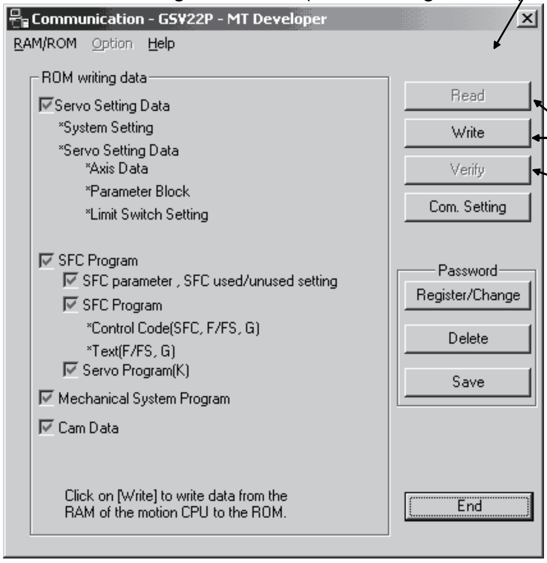


Transfer Data
- □ Batch
- ☑ Servo Setting Data
  - *System Setting
  - *Servo Setting Data
    - *Axis Data
    - *Parameter Block
    - *Limit Switch Setting
- □ SFC Program
  - □ SFC parameter , SFC used/unused setting
  - □ SFC Program
    - *Control Code(SFC, F/FS, G)
    - *Text(F/FS, G)
    - *Unnecessary when SFC program is unused.
  - □ Servo Program(K)
- □ Mechanical System Program
- □ Cam Data
- □ Device Memory



2) Click on "ROM" of "RAM/ROM" menu screen.
Write the programs and data in the RAM of Motion CPU to the ROM.
(Note) : At "RAM" clicking on
Communication dialog is left screen (When selecting the RAM).
Read, write and verify to the RAM of Motion CPU.
Write the all data to Motion CPU after clicking on "RAM" at the ROM writing.

・"When selecting the ROM." (ROM writing window)



ROM writing data
- ☑ Servo Setting Data
  - *System Setting
  - *Servo Setting Data
    - *Axis Data
    - *Parameter Block
    - *Limit Switch Setting
- ☑ SFC Program
  - ☑ SFC parameter , SFC used/unused setting
  - ☑ SFC Program
    - *Control Code(SFC, F/FS, G)
    - *Text(F/FS, G)
  - ☑ Servo Program(K)
- ☑ Mechanical System Program
- ☑ Cam Data

Click on [Write] to write data from the RAM of the motion CPU to the ROM.

Not select these items.

3) "RAM/ROM" communication dialog is left screen (When selecting the ROM.).

4) Select "Write" of "When selecting the ROM" screen.
(Note) : ALL data are batch-written at the ROM writing.

- Mechanical system program and cam data cannot be written to the ROM when using the SW6RN-GSV13P.
  The above items are not displayed on the window.

POINT

Be sure to write the all data beforehand to the RAM of Motion CPU at the ROM writing.

MEMO

15 SECURITY FUNCTION

Refer to Section "1.3.4" for the correspondence version of the Motion CPU and the software.
This function is used to protect the user data of Motion CPU by registering a password.
The following user data can be protected in this function.
"Write Protection" or "Read/Write Protection" can be set every user data.

User data	Details
SFC program	Motion SFC programs (Control code, text) are protected.
Servo program	Servo programs and program allocation are protected.
Mechanical system program	Mechanical system programs are protected. (SV22 use)
Cam data	Cam data are protected. (SV22 use)

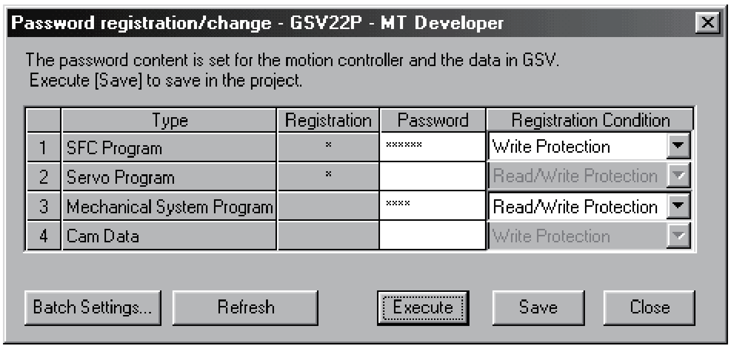
POINT

Security function can be used only by combining with operating system software (for security function) and SW6RN-GSV□P (for security function).

15.1 Password Registration/change

There are two following methods to register/change a password.

- [Communication] → [Password] → [Register/Change]
- Password [Register/Change] key of the communication setting screen displayed by "[Communication] → [Transfer]".



Password registration/change - GSV22P - MT Developer

The password content is set for the motion controller and the data in GSV.
Execute [Save] to save in the project.

	Type	Registration	Password	Registration Condition
1	SFC Program	*	******	Write Protection
2	Servo Program	*		Read/Write Protection
3	Mechanical System Program		****	Read/Write Protection
4	Cam Data			Write Protection

Items	Details
Type	• Type of user data
Registration	• "✻" is displayed when a password is registered in the Motion CPU.
Password	• Enter new password. • Set a password by the alphanumeric character (ASCII) of 6 or less characters. • Match case (Full-size character cannot be used.)
Registration condition	• A registration condition set in the Motion CPU is displayed. Write Protection: Not writing operation Read/Write Protection: Not reading/writing operation • New registration condition can be selected by a password input.

(1) Procedure for password registration/change

(a) A password and registration condition set in the Motion CPU are displayed.

(b) Enter new password in the password column, and select a registration condition (Write Protection, Read/Write Protection). It leaves in a blank for the user data that does not register/change a password.

(c) Push [Execute] key to register a password in the Motion CPU at the password registration.

(d) Push [Execute] key to display a screen which checks old password at the password change. Enter old password, and push [Execute] key. New password will be registered in the Motion CPU by success of old password check. When the new password is the same as old password (change for only registration condition), [Password check] screen is not displayed.

POINT

(1) If an user has forgotten a registration password, clear a password (include user data) of Motion CPU by [Clear All]. However, if [Clear All] is executed, since all password data and user data will be cleared re-write user data in the Motion CPU.

(2) ROM operation can be executed by user data registered a password. The password setting is also included in the ROM writing/reading data.

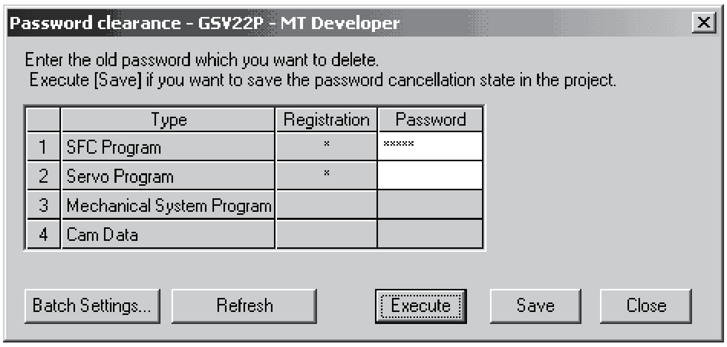
(3) When a password is registered or changed, the password data in the project is also registered or changed. Be sure to save a password.

(4) When an operation is stopped while a registration/change of password by reset or power OFF of Motion CPU, the data may not be registered. In this case, register or change a password again to restore the user data.

15.2 Password Clearance

There are two following methods to delete a password.

- [Communication] → [Password] → [Delete]
- Password [Delete] key of the communication setting screen displayed by "[Communication] → [Transfer]".



Password clearance - GSV22P - MT Developer

Enter the old password which you want to delete.
Execute [Save] if you want to save the password cancellation state in the project.

	Type	Registration	Password
1	SFC Program	*	*****
2	Servo Program	*	
3	Mechanical System Program		
4	Cam Data		

Items	Details
Type	• Type of user data
Registration	• "✻" is displayed when a password is registered in the Motion CPU.
Password	• Enter old password.

(1) Procedure for password clearance

(a) The password data set in the Motion CPU are displayed.

(b) Enter old password in the password column, and push [Execute] key.

(c) A password set in the Motion CPU will be deleted by success of password check. (A blank is displayed in the registration column.)

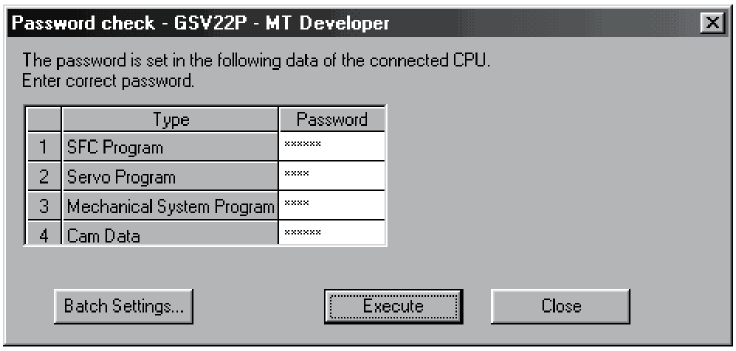
POINT

(1) When a password is deleted, the password data in the project is also deleted. Be sure to save a password.

(2) When an operation is stopped while a clearance of password by reset or power OFF of Motion CPU, the data may not be deleted. In this case, delete a password again to restore the user data.

15.3 Password Check

When the user data program set in a password is corrected, the password check screen is displayed automatically.



Password check - GSV22P - MT Developer

The password is set in the following data of the connected CPU.
Enter correct password.

	Type	Password
1	SFC Program	******
2	Servo Program	****
3	Mechanical System Program	****
4	Cam Data	******

Items	Details
Type	• Type of user data
Password	• Enter old password.

(1) Procedure for password check

(a) Enter old password in the password column, and push [Execute] key.

(b) A password protection set in the Motion CPU will be released temporarily by success of password check, and the user data program can be corrected.

(c) A password is memorized until SW6RN-GSV□P ends. (Since a password is released automatically at the user data correction, a password check screen is not displayed.)

POINT

A password memorized by success of password check is valid even if the project change is executed while SW6RN-GSV□P is running. (A password check screen is not displayed.)

15.4 Password Save

There are two following methods to save a password in the project data.
- Registration/change or clearance password
- A password read with user data by [Transfer] → [Read].

A password saved in the project data can be registered with user data, when the user data are written in the Motion CPU that does not set password by [Transfer] → [Write].

The updated password data is saved in the project data by the following operations.
- Password [Save] key of communication setting screen displayed by "[Communication] → [Transfer]".
- Password [Save] key of password registration/change/clearance screen.
- When the password registration/change/clearance screen ends, if there is non-saved password data, select "Yes" of save check screen.

(1) A password and registration conditions for each operation

Operation	Password and registration conditions
Read	When a password is set in the call source Motion CPU, the password contents are called and the password data in the project are written.
Write	When a password data is set in the project, if a password is not set in the write designation Motion CPU, the password contents are also written.
Verification	Password data in the project are not updated.
ROM writing	Password contents registered in the write designation Motion CPU are written in ROM.
Online change	Password contents of write designation Motion CPU are not updated.
Backup	It is saved in backup data including also the password contents registered in the call source Motion CPU. The password data in the project is not updated.
Load	Password contents in backup data are written in the write designation Motion CPU.
Password registration/ change	New password contents are written in the write designation Motion CPU. Password data in the project is also updated to new password contents.
Password clearance	A password is deleted from the write designation Motion CPU. A password is deleted also from the password data in the project.
Project diversion ([Project management]) - [File diversion])	The password data in diverting source project is not diverted.

The password data in the project is not saved in the project before password save.

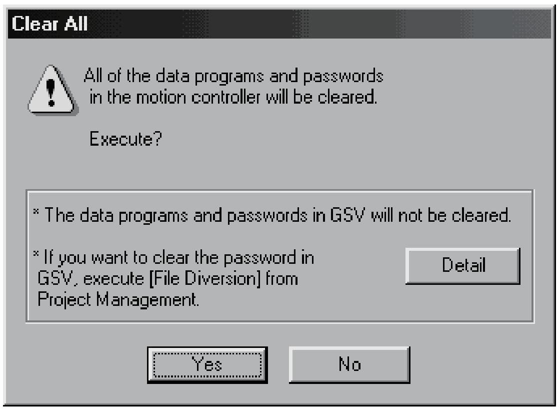
POINT

Save a password after delete of password to delete the password data in the project. Or, create new project and divert user data from the project with password data to create the project without password data.

15.5 Clear All

This function is used to clear the all user data and password setting in Motion CPU. Clear all can be executed in the following operation.

- Select "[Option] → [Clear All]" of the communication screen displayed by "[Communication] → [Transfer]".



Clear All

All of the data programs and passwords in the motion controller will be cleared.

Execute?

* The data programs and passwords in GSV will not be cleared.

* If you want to clear the password in GSV, execute [File Diversion] from Project Management.

POINT

(1) Turn off the PLC ready flag (M2000) and test mode ON flag (M9075) to execute "Clear All".

(2) Turn off the power supply of servo amplifier.

(3) All user data and password setting are cleared at the "Clear All". Backup of user data and password setting data is recommended before clearance.

16. COMMUNICATIONS VIA NETWORK

Refer to Section "1.3.4" for the correspondence version of the Motion CPU and the software.
The communication between the personal computer and the Motion CPU is possible via Q series Network module (MELSECNET/10(H), Ethernet, CC-Link, RS-232 and etc.) in the Motion CPU (Q173CPU(N)/Q172CPU(N)).
Refer to the following manuals for the specifications of each network modules of MELSECNET/10(H), Ethernet, CC-Link and Serial communication, the handling method.

(1) MELSECNET/10(H) module : QJ71LP21-25, QJ71LP21G, QJ71BR11,
QJ72LP25-25, QJ72LP25G, QJ72BR15
- QCPU User's Manual(Hardware Design, Maintenance and Inspection)
- Q Corresponding MELSECNET/H Network System Reference Manual(PLC to PLC network)
- Q Corresponding MELSECNET/H Network System Reference Manual(Remote I/O network)

(2) Ethernet interface module : QJ71E71, QJ71E71-B2, QJ71E71-100
- Q Corresponding Ethernet Interface Module User's Manual(Hardware)
- Q Corresponding Ethernet Interface Module User's Manual(Basic)
- Q Corresponding Ethernet Interface Module User's Manual(Application)
- Q Corresponding Ethernet Interface Module User's Manual(Web function)
- Q Corresponding MELSEC Communication Protocol Reference Manual

(3) CC-Link module : QJ61BT11
- QJ61BT11 Control & Communication Link System Master/Local Module User’s Manual(Hardware)
- GX Configurator-CC Version 1 Operating Manual
- CC- Link System Master/Local Module User’s Manual

(4) Serial communication module : QJ71C24, QJ71C24-R2
- Serial Communication Module User's Manual(Hardware)
- Q Corresponding Serial Communication Module User's Manual(Basic)
- Q Corresponding Serial Communication Module User's Manual(Application)
- Q Corresponding MELSEC Communication Protocol Reference Manual

16.1 Specifications of The Communications via Network

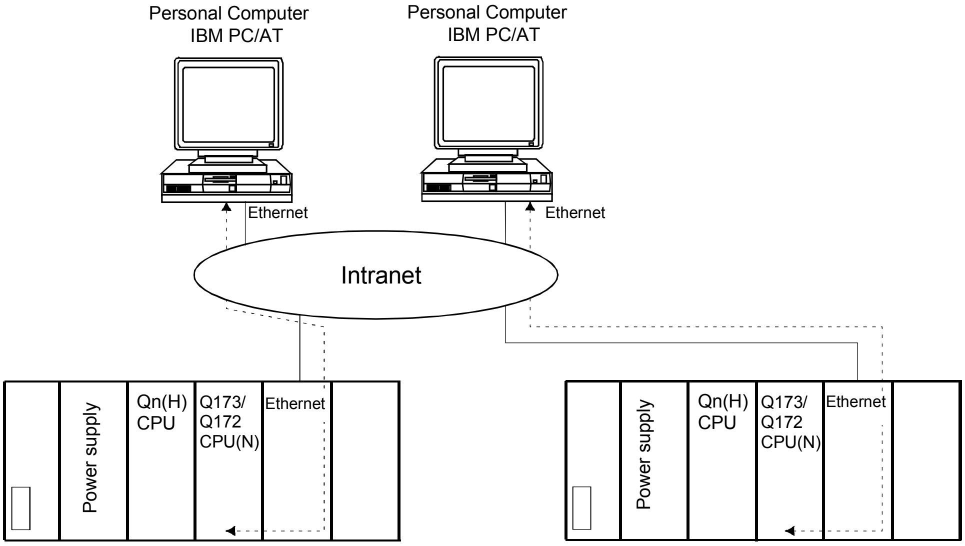
(1) Communications via network of the Motion CPU is possible by SW6RN-GSV□P.

(2) Access range of the communications via network of the Motion CPU is an access range equivalent to Qn(H)CPU. (Refer to Section "16.2 Access Range of The Communications via Network".)

(3) By setting the routing parameter to the control CPU of the network module and the CPU which connected the peripheral devices in the network by MELSECNET/10(H) and Ethernet, it is possible to relay to 8 network points and communicate.

(4) Because the Motion CPU cannot become the control CPU of the network module, there is not setting item of the network module and network parameter. However, when connecting with the CPU on the other network from the peripheral device which connected the Motion CPU, it needs to the setting of the routing parameter.

(5) It can operate by remote control the monitor or program editing of the Motion CPU via the intranet using the Ethernet module.



16.2 Access Range of The Communications via Network

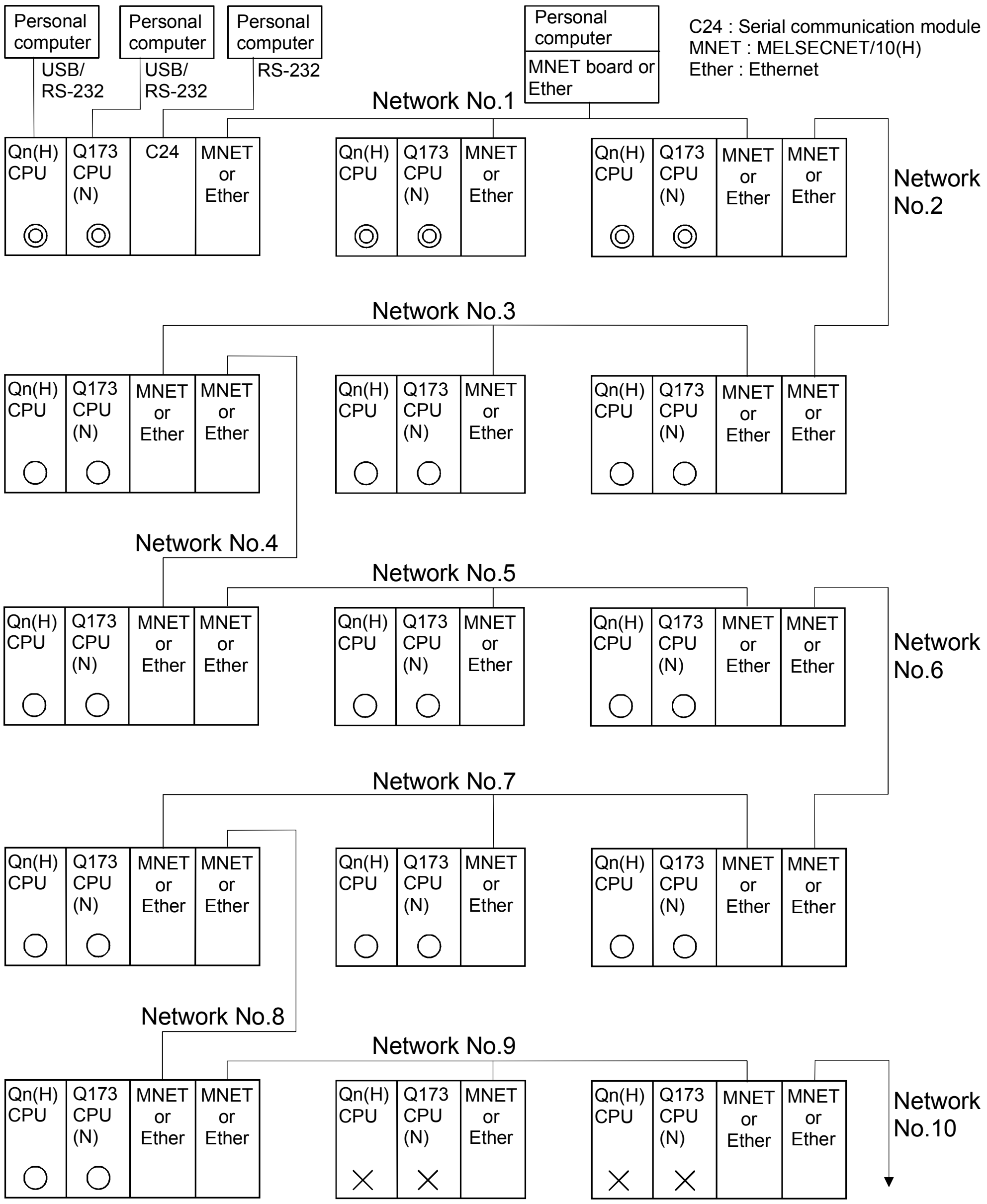
16.2.1 Network configuration via the MELSECNET/10(H) or the Ethernet

(1) It can access the other CPU via the network from the programming software (GX Developer, SW6RN-GSV□P, etc.) of the personal computer connected with the CPU or serial communication module in USB/RS-232.

(2) It can access the other CPU via the network from the programming software in the personal computer by connecting the personal computer equipped with Ethernet to MELSECNET/10(H) or Ethernet board to the Ethernet to MELSECNET/10(H) or Ethernet.

(3) The access range of above (1) and (2) can be accessed to 8 network points by setting the routing parameter to the control CPU of the network module and the CPU which connected the personal computer.

<Example>



◎ : Communication is possible

○ : Communication is possible (Setting of the routing parameter is necessary.)

╳ : Communication is impossible

16.2.2 Network configuration via the CC-Link

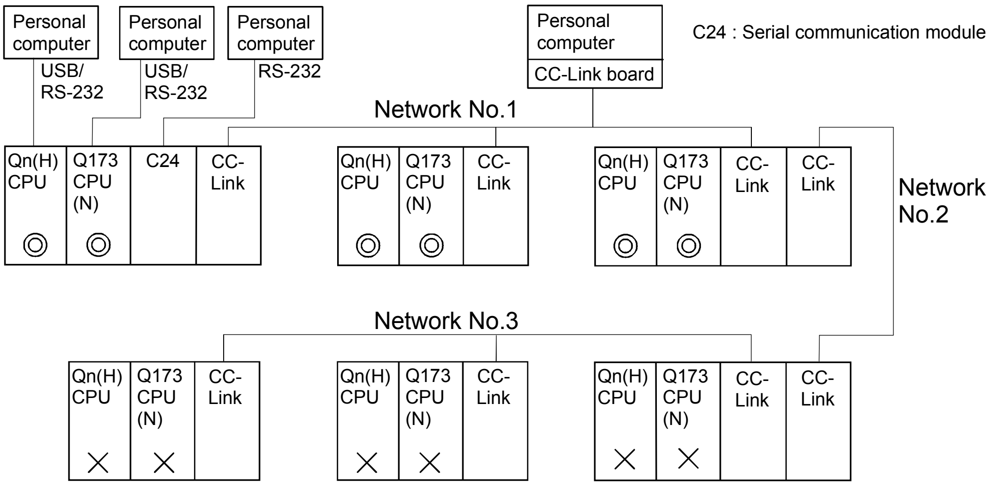
(1) It can access the other CPU via the CC-link from the programming software (GX Developer, SW6RN-GSV□P, etc.) of the personal computer connected with the CPU or serial communication module in USB/RS-232.

(2) It can access the other CPU via the CC-Link from the programming software in the personal computer by connecting the personal computer equipped with CC-Link board to the CC-Link.

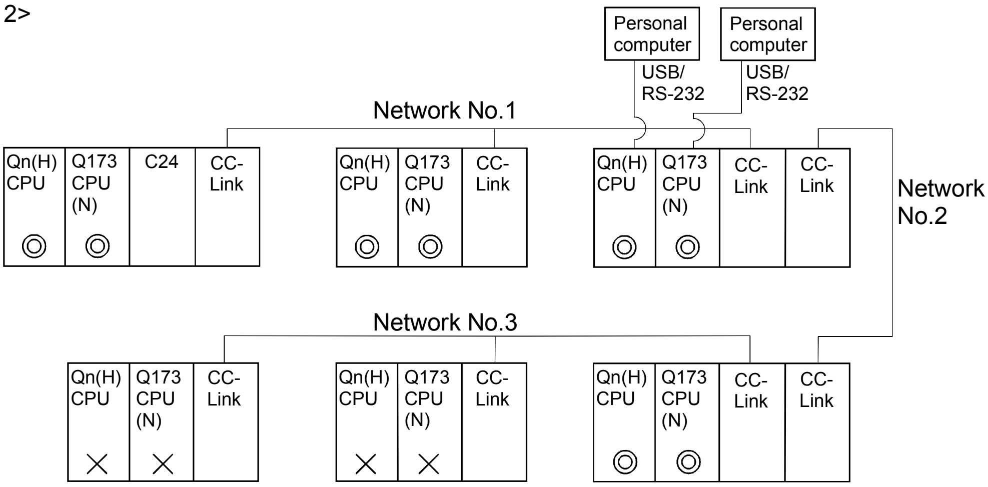
(3) The access range of above (1) is only the CPU on the CC-Link which a system connects it to, and it can select a CC-Link network to connect by specifying the I/O No. of the CC-Link module.

(4) The access range of above (2) is only the CPU of the connected the CC-Link.

<Example 1>



<Example 2>



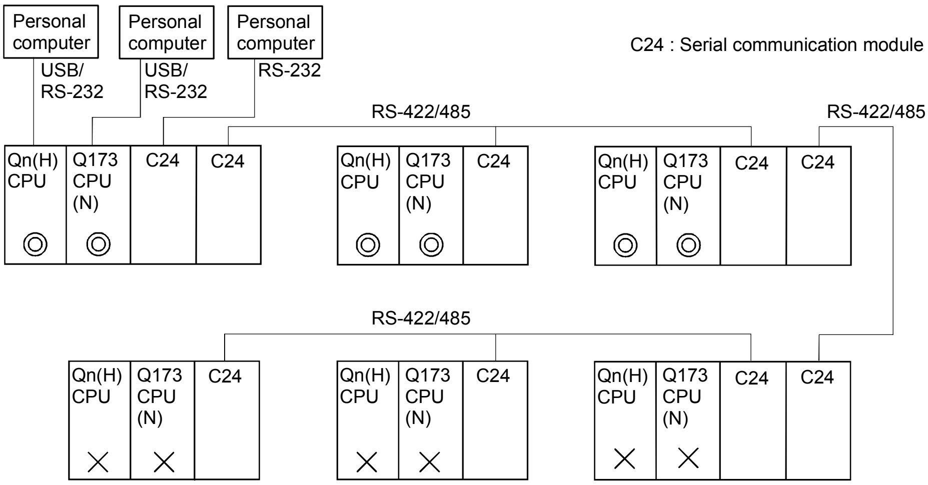
◎ : Communication is possible
○ : Communication is possible (Setting of the routing parameter is necessary.)
× : Communication is impossible

16.2.3 Network configuration via the RS422/485

(1) It can access the other CPU via the RS-422/485 from the programming software (GX Developer, SW6RN-GSV□P, etc.) of the personal computer connected with the CPU or serial communication module in USB/RS-232.

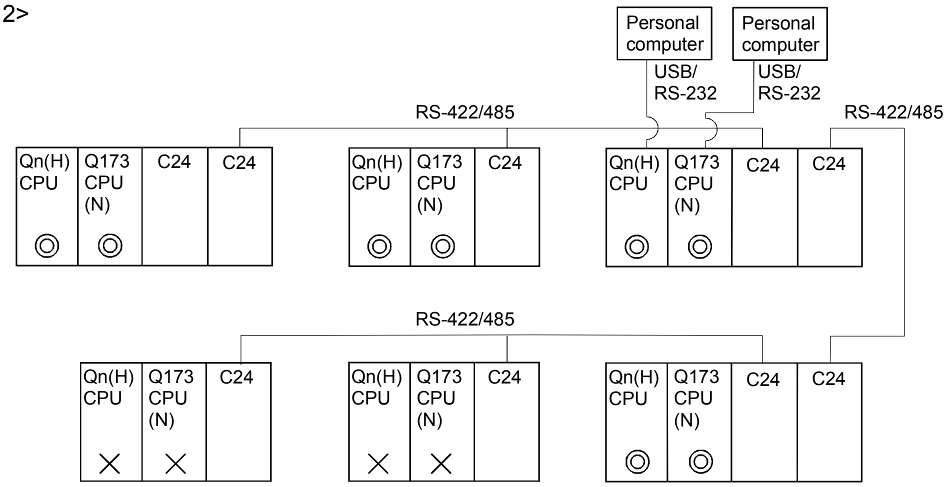
(2) The access range of above (1) is only the CPU on the RS-422/485 which a system connects it to, and it can select RS-422/485 network to connect by specifying the I/O No. of the C24 module.

<Example 1>



C24 : Serial communication module

<Example 2>



◎ : Communication is possible
○ : Communication is possible (Setting of the routing parameter is necessary.)
✕ : Communication is impossible

16.2.4 Network configuration which MELSECNET/10(H), Ethernet, CC-Link, RS-422/485 were mixed

(1) When the MELSECNET/10(H) or Ethernet is defined as "Network" and CC-Link or RS-422/485 is defined as "Link", combination of whether to be able to access from the programming software (GX Developer, SW6RN-GSV□P, etc.) is shown below.

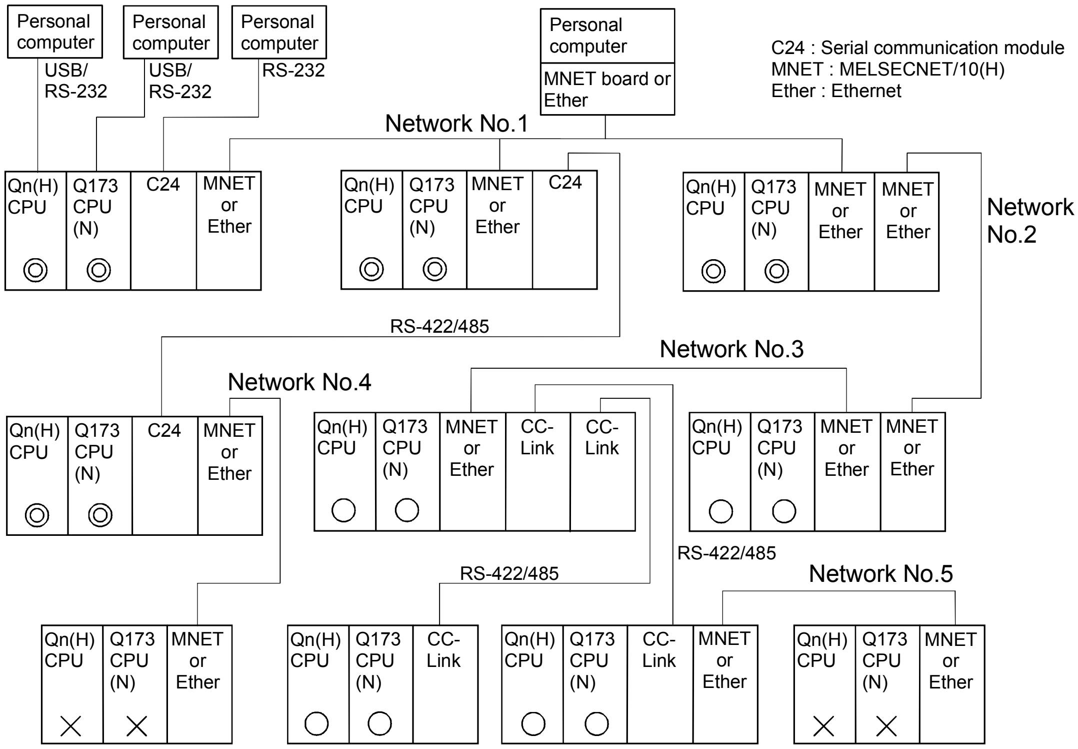
Network communications	Usable/ unusable
Programming software → CPU (C24) → Network → Link → CPU	○
Programming software → CPU (C24) → Link → Network → CPU	○
Programming software → Network → Link → CPU	○
Programming software → Link → Network → CPU	○
Programming software → CPU (C24) → Network → Link → Network → CPU	×
Programming software → CPU (C24) → Link → Network → Link → CPU	×
Programming software → Network → Link → Network → CPU	×
Programming software → Link → Network → Link → CPU	×

○ : Usable × : Unusable

(2) It can be accessed to 8 network points by setting the routing parameter in the "Network".

(3) Because routing cannot access, it can access only the connected network. The connected network can be selected by specifying the I/O No. of the module.

<Example 1>

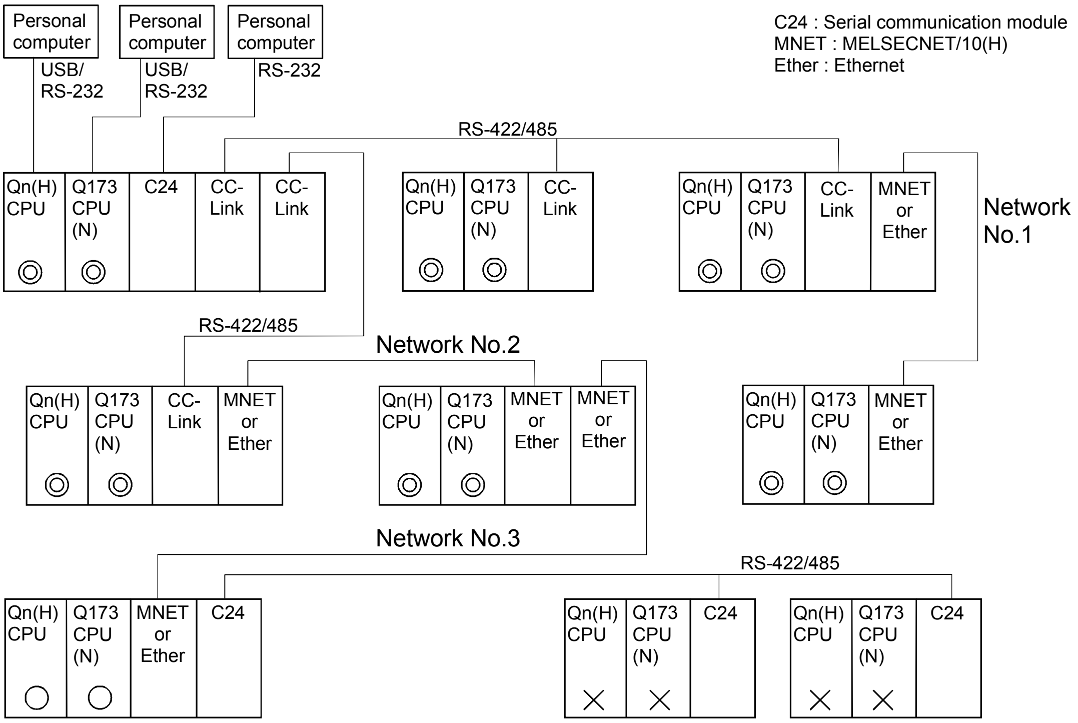


◎ : Communication is possible

○ : Communication is possible (Setting of the routing parameter is necessary.)

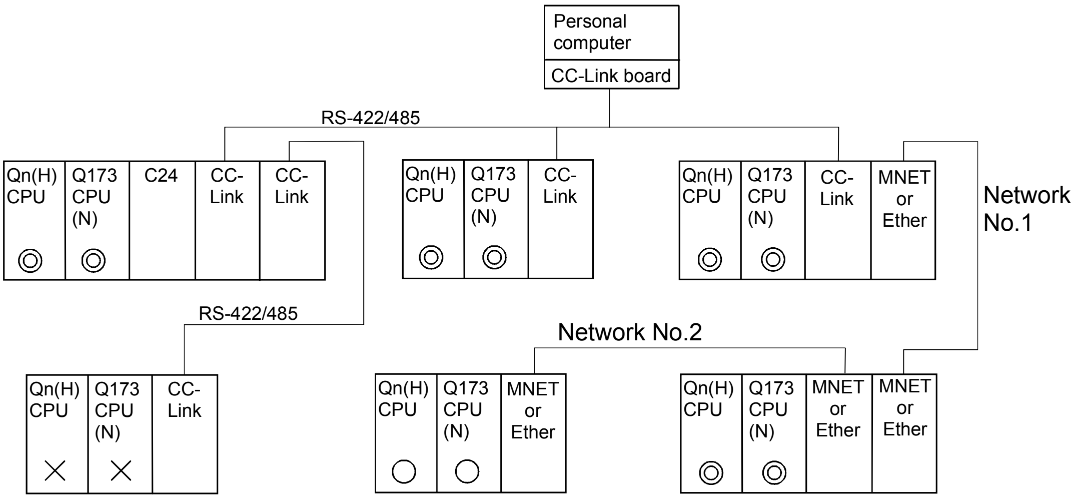
× : Communication is impossible

<Example 2>



C24 : Serial communication module
MNET : MELSECNET/10(H)
Ether : Ethernet

<Example 3>



◎ : Communication is possible
○ : Communication is possible (Setting of the routing parameter is necessary.)
× : Communication is impossible

MEMO

17. MONITOR FUNCTION OF THE MAIN CYCLE

Refer to Section "1.3.4" for the correspondence version of the Motion CPU and the software.

(1) Information for main cycle of the Motion CPU processing (process cycle executed at free time except for motion control) is stored to the special register.

(2) Since the automatic refresh of shared CPU memory and normal task of Motion SFC program are executed in the main cycle, make it reference for process time, etc. to program.

(3) There are following methods to shorten a main cycle.
  (a) Lengthen an operation cycle setting.
  (b) Reduce the number of event task programs to execute in the Motion SFC program.
  (c) Reduce the number of normal task programs to execute simultaneously in the Motion SFC program.
  (d) Reduce the number of automatic refresh points of shared CPU memory.

(4) When a main cycle is lengthened (more than 1.6[s]), a WDT error may occur in the Motion CPU.

(5) Details of main cycle monitor register is shown below.

No.	Name	Meaning	Details
D9017	Scan time	Current scan time (1ms units)	• Current scan time is stored in the unit 1[ms]. • Setting range (0 to 65535[ms])
D9019	Maximum scan time	Maximum scan time (1ms units)	• Maximum main cycle is stored in the unit 1[ms]. • Setting range (0 to 65535[ms])

MEMO

18. SERVO PARAMETER READING FUNCTION

Refer to Section "1.3.4" for the correspondence version of the Motion CPU and the software.

(1) When the servo parameters are changed, the Motion CPU will be automatically read the servo parameters and reflected them to the servo parameter storage area in the Motion CPU. Therefore, an operation to read servo parameters is unnecessary in the following cases.

(a) The parameters are changed by auto tuning.

POINT

If the power supply of Motion CPU is turned off/reset or the power supply of servo amplifier is turned off immediately after change, it may not be reflected.

(2) After executing the servo parameter reading function, when it needs to reflect the servo parameters changed to the SW6RN-GSV□P, read the servo parameters from the Motion CPU and save data.

18.1 About The Servo Parameter Read Request Devices

(1) Set the axis No. of servo amplifier to read a parameter in the servo parameter read request axis No. (D9104) and turn the servo parameter read request flag (M9104) ON for reading of the servo parameter from servo amplifier.

(2) While the servo parameter reading flag (M9105) is turned on, the servo parameter read request flag does not become valid. Use this condition as an interlocks.

(3) Reading of servo parameter from servo amplifier becomes valid at the turning OFF to ON of the servo parameter read request flag.

(4) The servo parameter read request flag is not turned off automatically. Execute the device OFF processing by the user side.

(5) After executing the read function of the servo parameter from servo amplifier, when the servo parameter read request is executed toward the other axis, turn the servo parameter read request flag (M9104) OFF to ON, set the correspondence axis in the servo parameter read request axis No. (D9104) and turns the servo parameter read request flag (M9104) OFF to ON.

(6) After executing the read function of the servo parameter from servo amplifier, when the servo parameter read request is executed toward the same axis again, turn the servo parameter read request flag (M9104) ON to OFF, and turn the servo parameter read request flag (M9104) OFF to ON again.

(7) When the servo parameter read request flag (M9104) turns OFF to ON, if the servo parameter read request axis is not used or the power is off, the reading of the servo parameter from servo amplifier is not executed.

(8) When the servo parameter read request axis No. (D9104) is outside of the setting range, it becomes "No operation" even if the servo parameter read request flag (M9104) turns OFF to ON.

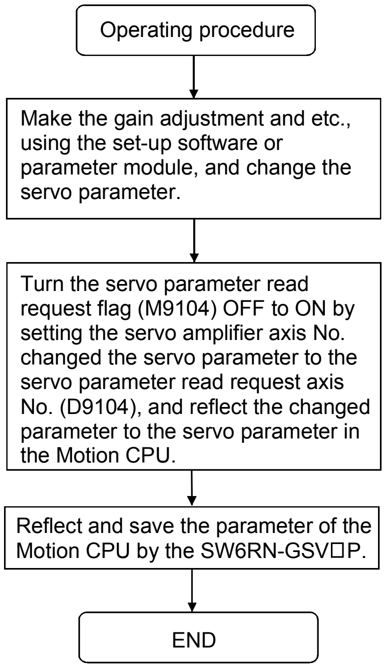
(9) The list of the servo parameter read request device is shown below.

No.	Name	Meaning	Details
M9104	Servo parameter read request flag	OFF to ON : Servo parameter read.	• The servo parameter of the servo parameter read request axis set as D9104 is reflected in the Motion CPU from the servo amplifier at the time of off to on.
M9105	Servo parameter reading flag	ON : Servo parameter reading. OFF : Except the servo parameter reading.	• Turned on while reading the servo parameter from the servo amplifier to the Motion CPU. After reading is turned off automatically.

D9104	Servo parameter read request axis No.	Servo parameter read axis No.	• Set the axis No. of servo amplifier to read the servo parameter.
			• Setting range
			Q173CPU(N) : 1 to 32 (Axis1 to 32)
			Q172CPU(N) : 1 to 8 (Axis1 to 8)

18.2 Operating Procedure of The Servo Parameter Reading Function

An operation procedure which the servo parameter read by the reading function of the servo parameter is reflected on the SW6RN-GSV□P is shown below.



Operating procedure

Make the gain adjustment and etc., using the set-up software or parameter module, and change the servo parameter.

Turn the servo parameter read request flag (M9104) OFF to ON by setting the servo amplifier axis No. changed the servo parameter to the servo parameter read request axis No. (D9104), and reflect the changed parameter to the servo parameter in the Motion CPU.

Reflect and save the parameter of the Motion CPU by the SW6RN-GSV□P.

END

19. ERROR CODE LISTS

When an error occurs while the Motion CPU is running, the error information is stored in the error history register (#8000 to #8063), special relay M and special register D.

19.1 Reading Procedure for Error Codes

When an error occurs while the Motion SFC program is operating, the error code and error message can be read by the SW6RN-GSV□P.
The procedure for reading error codes by the SW6RN-GSV□P is shown below.

(1) Start the SW6RN-GSV□P.
(2) Connect the Q173CPU(N)/Q172CPU(N) to the peripheral devices.
(3) Select [New project] create the project- [Read from Motion CPU] Menu by the SW6RN-GSV□P, and also read the project from the Motion CPU.
(4) Select the [Monitor] - [Error list] - [Motion SFC error history] and [Error list] Menu.
(5) Display the error code and error message.

Refer to the applicable the help of the SW6RN-GSV□P for details of the SW6RN-GSV□P operating method.
The occurrence date of the Motion CPU error history uses a watch function with the internal Motion CPU.
Make the set of the clock data and the clock data read request (M9028) by user programs.
As for the self-diagnosis error code, confirmation can be done by the PC diagnosis of GX Developer.
Refer to the GX Developer operation manual for the GX Developer operation procedure.

19.2 Motion SFC Error Code List

Eight errors that occurred in the past during the Motion SFC control are stored in the "error history devices (#8000 to #8063)" of the motion registers. (Check by SW6RN-GSV□P).

The "error codes" for the Motion SFC program are shown below.

Refer to the "Q173CPU(N)/Q172CPU(N) Motion controller (SV13/SV22) Programming Manual (REAL MODE)"/ "Q173CPU(N)/Q172CPU(N) Motion controller (SV22) Programming Manual (VIRTUAL MODE)" for minor errors, major errors, servo errors and servo program setting errors.

Table 19.1 Motion SFC dedicated devices (#8000 to #8063)

Device No.	Signal name		Signal direction		Refresh cycle	Fetch cycle
			Status	Command		
#8000 to	Seventh error information in past (Oldest error information)	Motion SFC error history (8 errors) (64 points)	○	—	At error occurrence	—
#8008 to	Sixth error information in past					
#8016 to	Fifth error information in past					
#8024 to	Fourth error information in past					
#8032 to	Third error information in past					
#8040 to	Second error information in past					
#8048 to	First error information in past					
#8056 to #8063	Latest error information					

No.	Signal name	
+0	Error Motion SFC program No.	
1	Error type	
2	Error program No.	
3	Error block No. / Motion SFC list / Line No. / Axis No.	
4	Error code	
5	Error occurrence time	Year/ Month
6		Day/ Hour
7		Minute/ Second

Table 19.2 Motion SFC program start errors (16000 to 16099)

Error code	Error factor		Error Processing	Corrective Action
	Name	Description		
16000	PLC ready OFF (SFCS)	• At a start by S(P).SFCS instruction, PLC ready flag (M2000) or PCPU ready flag (M9074) is OFF.	The specified Motion SFC program does not start.	Provide ON of the PLC ready flag (M2000) and PCPU ready flag (M9074) as start interlocks.
16001	Motion SFC program No. error (SFCS)	• At a start by S(P).SFCS instruction, the range of 0 to 255 is specified in the Motion SFC program No..		Check the Motion SFC program No., and correct a PLC program.
16002	None Motion SFC program (SFCS)	• At a Motion SFC program start by S(P).SFCS instruction, the specified Motion SFC program does not exist.		Check the Motion SFC program No., and correct a PLC program, or create the non-created Motion SFC program.
16003	Double start error	• At a Motion SFC program start by S(P).SFCS instruction, the same Motion SFC program starts.		Double start should be managed on the user side. Provide the user's starting signal as a start interlock in the PLC program.
16004	PLC ready OFF (GINT)	• S(P).GINT instruction was executed with PLC ready flag (M2000) or PCPU ready flag (M9074) is OFF.	The active step of Motion SFC program executed by "PLC interrupt" is not processed.	Provide ON of PLC ready flag (M2000) and PCPU ready flag (M9074) as S(P).GINT execution interlocks.
16005	None Motion SFC program	• At a Motion SFC program start by automatic start setting or GSUB, the specified Motion SFC program does not exist.	The specified Motion SFC program does not start. When it started by GSUB, the start source Motion SFC also stop to execute.	Check the Motion SFC program No., and correct a program, or create the non-created Motion SFC program.
16006	Double start error	• At a Motion SFC program start by automatic start setting or GSUB, the same Motion SFC program is already starting.		Double start should be managed on the user side. Provide the user's starting signal as an interlocks in the transition condition.
16007	Online change	• The Motion SFC program which is rewriting the Motion SFC chart by online change was started.	The specified Motion SFC program does not start.	Start after the completion of online change.

Table 19.3 Motion SFC interpreter detection errors (16100 to 16199)

Error code	Error factor		Error Processing	Corrective Action
	Name	Description		
16100	Motion SFC program error (grammatical error)	• The code exists but is grammatically erroneous. • Though not within branch-coupling, a label/jump code within selective branch-coupling or a label/jump code within parallel branch-coupling exists.	Stop to execute the applicable Motion SFC program No.. For the subroutine called program, the call source program also stops to execute.	The Motion SFC program code is corrupted. Turn PLC ready flag (M2000) OFF and write the Motion SFC program again. Or, replace the external battery if it passed over a life.
16101		• Selective branch destinations are all headed by other than SFT or WAIT transitions.		
16102		• WAITON/WAITOFF is not followed by a motion control step. (However, this is permitted to a pointer (Pn) or jump (Pn).)		
16103		• A parallel branch is followed by an END step without a parallel coupling.		
16104	Motion SFC code error	• An impossible code is used. The internal code is corrupted.		
16105	Jump code error 1	• Internal code (list code) error in jump destination information		
16106	Jump code error 2	• Internal code (label information) error in jump destination information		
16107	Jump code error 3	• Internal code (label No.) error in jump destination information		
16108	Jump code error 4	• Internal code (label address) error in jump destination information		
16109	Jump destination error	• The specified pointer does not exist at the jump destination.		

Table 19.3 Motion SFC interpreter detection errors (16100 to 16199) (continued)

Error code	Error factor		Error Processing	Corrective Action
	Name	Description		
16110	GSUB setting error 1	• The self program was called/started by GSUB.	Stop to execute the applicable Motion SFC program No.. For the subroutine called program, the call source program also stops to execute.	GSUB cannot call its own or main program. Correct the Motion SFC program.
16111	GSUB setting error 2	• The main program was called/started by GSUB.		
16112	Parallel branch nesting excess	• Nesting of parallel branches within a parallel branch route exceeded four levels.		The nesting of parallel branch is up to four levels. Subroutine the branch destination processing and correct the program.
16113	Executed task error	• An attempt was made to execute a motion control step K with an event or NMI task.		Motion control steps cannot be executed in the Motion SFC programs executed by the event and NMI tasks.
16120	Simultaneously active step count excess	• The number of simultaneously active steps exceeded 256 during execution.		Number of simultaneously active steps is maximum 256. Re-examine the Motion SFC program.

Table 19.4 Motion SFC program run errors (16200 to 16299)

Error code	Error factor		Error Processing	Corrective Action
	Name	Description		
16200	No specified program (Kn)	• The servo program (Kn) specified with the motion control step does not exist.	Stop to execute the applicable Motion SFC program No.. For the subroutine called program, the call source program also stops to execute.	Create the specified servo program.
16201	No specified program (Fn/FSn)	• The operation control program (Fn/FSn) specified with the operation control step does not exist.		Create the specified operation control program.
16202	No specified program (Gn)	• The program (Gn) specified with the transition does not exist.		Create the specified transition program.
16203	No specified program (Motion SFC)	• The Motion SFC program specified with the clear step does not exist.		Correct the specified Motion SFC program name or create the specified Motion SFC program.
16204	No setting of operation expression/conditional expression	• The program (Gn) specified with the transition does not have a conditional expression setting.		Be sure to set a conditional expression in the last block of the transition program.
16205	Fn/FSn program code error	• Internal code error in the operation control program (Fn/FSn)		The Motion SFC program code is corrupted. Turn PLC ready flag (M2000) OFF and write the Motion SFC program again. Or, replace the external battery if it passed over a life.
16206	Gn program code error	• Internal code error in the transition program (Gn)		
16207	Specified the invalid device	• The invalid device (T, C) in the program is set up.		Correct the program which does set the effective device.

Table 19.5 Operation control/transition execution errors (16300 to 16599)

Error code	Error factor		Error Processing	Corrective Action
	Name	Description		
16301	Event task enable (EI) execution error	• Event task enable was executed at except for the normal task.	The block processing on executing is stopped and the next block is executed.	Event task enable may be executed in the normal task only. Correct the program.
16302	Event task disable (DI) execution error	• Event task disable was executed at except for the normal task.		Event task disable may be executed in the normal task only. Correct the program.
16303	Block transfer (BMOV) execution error	• The cam data of the cam No. specified with (D) or (S) is not yet registered to the Motion controller. • The resolution of the cam No. specified with (D) or (S) differs from the number of transferred words specified with (n). • (S) to (S)+(n-1) is outside the device range. • (D) to (D)+(n-1) is outside the device range. • (n) is 0 or a negative number. • (S) is a bit device and the device number is not a multiple of 16 • (D) is a bit device and the device number is not a multiple of 16. • PX/PY is set in (S) to (S)+(n-1). • PX/PY is set in (D) to (D)+(n-1).		• Correct the program so that cam data is that of the already registered cam No.. • Correct the program to match (n) with the cam resolution. • Change (n) so that the block transfer range is within the device range. • Change (n) to a positive number. • When (S) or (D) is a bit device, set the device number to be multiple of 16. • When (S) or (D) is a bit device, do not set PX/PY.
16304	Time to wait (TIME) execution error	• The device No. which indirectly specifies (S) is illegal. • The (S) data is outside the range 0 to 2147483647.		• Correct the program so that the device No. which indirectly specifies (S) is proper. • Correct the program so that the (S) data is within the range of 0 to 2147483647.
16305	Same data block transfer (FMOV) execution error	• (D) to (D)+(n-1) is outside the device range. • (n) is 0 or a negative number. • (S) is a bit device and the device number is not a multiple of 16 • (D) is a bit device and the device number is not a multiple of 16. • PX/PY is set in (S). • PX/PY is set in (D) to (D)+(n-1).		• Change (n) so that the block transfer range is within the device range. • When (S) or (D) is a bit device, set the device number to be multiple of 16. • When (S) or (D) is a bit device, do not set PX/PY.
16308	Speed change request (CHGV) execution error	• The specified axis No. is outside the range.		Correct the program so that the specified axis No. is within the range.
16309	Torque limit value change request (CHGT) execution error			
16316	Assignment (=) execution error	• The (S) data is outside the range of the data type of (D). • The device No. which indirectly specifies (D) is illegal.		• Correct the program so that the (S) data is within the range of the data type of (D). • Correct the program so that the device No. which indirectly specifies (D) is proper.
16320	Operation (/) execution error	• The divisor is 0.		Correct the program so that the divisor is other than 0.
16321	Remainder (%) execution error			
16322	Device set (SET) execution error	• The device No. which indirectly specifies (D) is illegal. • (D) is a device which is write-disabled.		• Correct the program so that the device No. which indirectly specifies (D) is proper. • Correct the program to set a write-enabled device at (D).
16333	Device reset (RST) execution error			
16334	Device set (SET=) execution error			
16335	Device reset (RST=) execution error			
16336	Device output (DOUT) execution			
16337	Device input (DIN) execution error	• The device No. which indirectly specifies (D) is illegal.		Correct the program so that the device No. which indirectly specifies (D) is proper.
16338	Bit device output (OUT=) execution error			

Table 19.5 Operation control/transition execution errors (16300 to 16599) (continued)

Error code	Error factor		Error Processing	Corrective Action
	Name	Description		
16380	Signed 16-bit integer value conversion (SHORT) execution error	• The (S) data is outside the signed 16-bit integer value range.	The block processing on executing is stopped and the next block is executed.	Correct the program so that the (S) data is within the signed 16-bit integer value range.
16337	Device input (DIN) execution error	• The device No. which indirectly specifies (D) is illegal.		Correct the program so that the device No. which indirectly specifies (D) is proper.
16338	Bit device output (OUT=) execution error			
16380	Signed 16-bit integer value conversion (SHORT) execution error	• The (S) data is outside the signed 16-bit integer value range.		Correct the program so that the (S) data is within the signed 16-bit integer value range.
16381	Unsigned 16-bit integer value conversion (USHORT) execution error	• The (S) data is outside the unsigned 16-bit integer value range.		Correct the program so that the (S) data is within the unsigned 16-bit integer value range.
16382	Signed 32-bit integer value conversion (LONG) execution error	• The (S) data is outside the signed 32-bit integer value range.		Correct the program so that the (S) data is within the signed 32-bit integer value range.
16383	Unsigned 32-bit integer value conversion (ULONG) execution error	• The (S) data is outside the unsigned 32-bit integer value range.		Correct the program so that the (S) data is within the signed 32-bit integer value range.
16398	Tangent (TAN) execution error	• (S) is 90+(180*n). (n is an integer)		Correct the program so that (S) is not 90+(180*n). (n is an integer)
16399	Arcsine (ASIN) execution error	• (S) is outside the range of -1.0 to 1.0.		Correct the program so that (S) is within the range of -1.0 to 1.0.
16400	Arccosine (ACOS) execution error			
16402	Square root (SQRT) execution error	• (S) is a negative number.		Correct the program so that (S) is a positive number.
16403	BCD→BIN conversion (BIN) execution error	• Any digit of (S) has a value other than 0 to 9.		Correct the program so that each digit of (S) is 0 to 9.
16404	BIN→BCD conversion (BCD) execution error	• The (S) value is outside the range where BIN data can be converted into BCD data.		Correct the program so that the (S) value is within the range.
16405	Natural logarithm (LN) execution error	• (S) is 0 or a negative number.		Correct the program so that (S) is a positive number.

Table 19.5 Operation control/transition execution errors (16300 to 16599) (continued)

Error code	Error factor		Error Processing	Corrective Action
	Name	Description		
16420	Write device data to shared CPU memory of the self CPU (MULTW) execution error	• Number of words (n) to be written is outside the range of 1 to 256. • The shared CPU memory address (D) of self CPU of the writing destination device is outside the range (800H to FFFH) of the shared CPU memory address. • The shared CPU memory address (D) of self CPU of the writing destination device + number of words (n) to be written is outside the range (800H to FFFH) of the shared CPU memory address. • First device No. (S) which writing data are stored + number of words (n) to be written is outside the device range. • MULTW instruction was executed again before MULTW instruction is executed and complete bit device is turned on. • (D1) is a write-disabled device. • (S) is a bit device and the device number is not a multiple of 16. • PX/PY is set in (S) to (S)+(n-1).	The block processing in execution is stopped and the next block is executed.	• Correct the program so that the number of words (n) to be written is within the range of 1 to 256. • Correct the program so that the shared CPU memory address (D) of self CPU of the writing destination is within the range of shared CPU memory address. • Correct the program so that the shared CPU memory address (D) of self CPU of the writing destination + number of words (n) to be written is within the range of shared CPU memory address. • Correct the program so that first device No. (S) which writing data are stored + number of words (n) to be written is within the device range. • Execute MULTW instruction again after the complete bit device of MULTW instruction is turned on. • Correct the program to set a write-enabled device at (D1). • When (S) is a bit device, set the device number to be multiple of 16. • When (S) is a bit device, do not set PX/PY.
16421	Read device data from shared CPU memory of the other CPU (MULTR) execution error	• Number of words (n) to be read is outside the range of 1 to 256. • The shared CPU memory first address (S2) of the data which it will be read is outside the range (000H to FFFH) of the shared CPU memory address. • The shared CPU memory first address (S2) of the data which it will be read + number of words (n) to be read is outside the range (000H to FFFH) of the shared CPU memory address. • First device No. (D) which stores the reading data + number of words (n) to be read is outside the device range. • Except 3E0H/3E1H/3E2H/3E3H is set at (S1). • The self CPU is specified with (S1). • The CPU which reads is resetting. • The errors are detected in the CPU which read. • (D) is a bit device and the device number is not a multiple of 16. • PX/PY is set in (D) to (D)+(n-1).		• Correct the program so that the number of words (n) to be read is within the range of 1 to 256. • Correct the program so that the shared CPU memory first address (S2) of the data which it will be read is within the range of shared CPU memory address. • Correct the program so that the shared CPU memory first address (S2) of the data which it will be read + number of words (n) to be read is within the range of shared CPU memory address. • Correct the program so that first device No. (D) which stores the reading data + number of words (n) to be read is within the device range. • Correct the program so that 3E0H/3E1H/3E2H/3E3H is set at (S1). • Correct the program so that the self CPU is not specified with (S1). • Check that the reset flag (M9240 to M9243) is OFF, then correct the program to execute the MULTR instruction. • If the errors are detected in the CPU which read, exchange the CPU. • When (D) is a bit device, set the device number to be multiple of 16. • When (D) is a bit device, do not set PX/PY.

Table 19.5 Operation control/transition execution errors (16300 to 16599) (continued)

Error code	Error factor		Error Processing	Corrective Action
	Name	Description		
16422	Write device data to intelligent function module/special function module (TO) execution error	• Number of words (n) to be written is outside the range of 1 to 256. • Motion CPU cannot communicate with intelligent function module/special function module at the instruction execution. • Abnormalities of the intelligent function module/ special function module were detected at the instruction execution. • I/O No.s specified with (D1) differ from the intelligent function module/special function module controlled by the self CPU. • The address specified with (D2) is outside the buffer memory range. • First device No. (S) which writing data are stored + number of words (n) to be written is outside the device range. • (S) is a bit device and the device number is not a multiple of 16. • PX/PY is set in (S) to (S)+(n-1).	The block processing in execution is stopped and the next block is executed.	• Correct the program so that the number of words (n) to be written is within the range of 1 to 256. • Replace the intelligent function module/ special function module if there is a fault. • Correct the program so that the first I/O No.s specified with (D1) is intelligent function module/special function module controlled by the self CPU. • Correct the program so that the address specified with (D2) is within the buffer memory range. • Correct the program so that first device No. (S) which writing data are stored + number of words (n) to be written is within the device range. • When (S) is a bit device, set the device number to be multiple of 16. • When (S) is a bit device, do not set PX/PY.
16423	Read device data from intelligent function module/special function module (FROM) execution error	• Number of words (n) to be read is outside the range of 1 to 256. • Motion CPU cannot communicate with intelligent function module/special function module at the instruction execution. • Abnormalities of the intelligent function module/ special function module were detected at the instruction execution. • I/O No.s specified with (S1) differ from the intelligent function module/special function module controlled by the self CPU. • The address specified with (S2) is outside the buffer memory range. • First device No. (D) which stores the reading data + number of words (n) to be read is outside the device range. • (D) is a bit device and the device number is not a multiple of 16. • PX/PY is set in (D) to (D)+(n-1).		• Correct the program so that the number of words (n) to be read is within the range of 1 to 256. • Replace the intelligent function module/ special function module if there is a fault. • Correct the program so that I/O No.s specified with (S1) is intelligent function module/special function module controlled by the self CPU. • Correct the program so that the address specified with (S2) is within the buffer memory range. • Correct the program so that first device No. (D) which stores the reading data + number of words (n) to be read is within the device range. • When (D) is a bit device, set the device number to be multiple of 16. • When (D) is a bit device, do not set PX/PY.
16462	Indirectly specified 16-bit motion device (#(n)) read error	• The indirectly specified device No. is outside the range.		Correct the program so that the indirectly specified device No. is proper.
16463	Indirectly specified 32-bit motion device (#(n)L) read error	• The indirectly specified device No. is outside the range or an odd number.		
16464	Indirectly specified 64-bit motion device (#(n)F) read error			
16465	Indirectly specified 16-bit data register (D(n)) read error	• The indirectly specified device No. is outside the range.		
16466	Indirectly specified 32-bit data register (D(n)L) read error	• The indirectly specified device No. is outside the range or an odd number.		
16467	Indirectly specified 64-bit data register (D(n)F) read error			

Table 19.5 Operation control/transition execution errors (16300 to 16599) (continued)

Error code	Error factor		Error Processing	Corrective Action
	Name	Description		
16468	Indirectly specified 16-bit link register (W(n)) read error	• The indirectly specified device No. is outside the range.	The block processing in execution is stopped and the next block is executed.	Correct the program so that the indirectly specified device No. is proper.
16469	Indirectly specified 32-bit link register (W(n)L) read error	• The indirectly specified device No. is outside the range or an odd number.		
16470	Indirectly specified 64-bit link register (W(n)F) read error			
16486	Indirectly specified input relay (X(n)) read error	• The indirectly specified device No. is outside the range.		
16487	Indirectly specified output relay (Y(n)) read error			
16488	Indirectly specified internal/latch relay (M(n)/L(n)) read error			
16489	Indirectly specified link relay (B(n)) read error			
16490	Annunciator (F(n)) read error			
16516	Indirectly specified 16-bit batch input relay (X(n)) read error	• The indirectly specified device No. is outside the range or is not a multiple of 16.		
16517	Indirectly specified 32-bit batch input relay (X(n)) read error			
16518	Indirectly specified 16-bit batch output relay (Y(n)) read error			
16519	Indirectly specified 32-bit batch output relay (Y(n)) read error			
16520	Indirectly specified 16-bit batch internal/latch relay (M(n)/L(n)) read error	• The indirectly specified device No. is outside the range or is not a multiple of 16.		
16521	Indirectly specified 32-bit batch internal/latch relay (M(n)/L(n)) read error			

Table 19.5 Operation control/transition execution errors (16300 to 16599) (continued)

Error code	Error factor		Error Processing	Corrective Action
	Name	Description		
16522	Indirectly specified 16-bit batch internal/latch relay (B(n)) read error	• The indirectly specified device No. is outside the range or is not a multiple of 16.	The block processing in execution is stopped and the next block is executed.	Correct the program so that the indirectly specified device No. is proper.
16523	Indirectly specified 32-bit batch internal/latch relay (B(n)) read error			
16524	Indirectly specified 16-bit batch annunciator (F(n)) read error			
16525	Indirectly specified 32-bit batch annunciator (F(n)) read error			

19.3 Motion SFC Parameter Errors

Motion SFC parameters are checked by SW6RN-GSV□P.

Table 19.6 PLC ready flag (M2000) OFF → ON errors (17000 to 17009)

Error code	Error factor		Error Processing	Corrective Action
	Name	Description		
17000	Normal task consecutive transition count error	• The normal task's consecutive transition count of the Motion SFC program started by the normal task is outside the range 1 to 30.	The initial value of 3 is used for control.	Turn PLC ready flag (M2000) OFF, make correction to set the value within the range, and write it to the CPU.
17001	Event task consecutive transition count error	• The set number of consecutive transitions of the Motion SFC program started by the event task is outside the range 1 to 10.	The initial value of 1 is used for control.	
17002	NMI task consecutive transition count error	• The set number of consecutive transitions of the Motion SFC program started by the NMI task is outside the range 1 to 10.		

Table 19.7 SFC Program start errors (17010 to 17019)

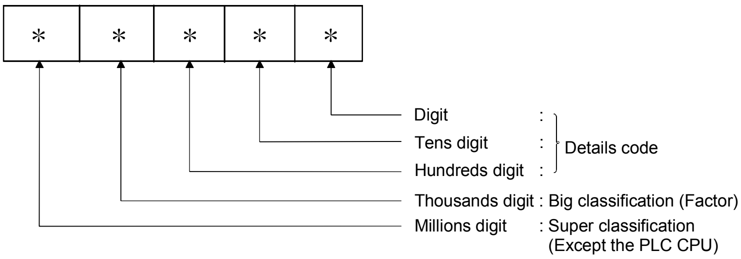
Error code	Error factor		Error Processing	Corrective Action
	Name	Description		
17010	Executed task setting is illegal	• Among the normal, event and NMI tasks, more than one or none of them has been set.	The initial value (normal task) is used for control.	Turn PLC ready flag (M2000) OFF, make correction, and write a correct value to the CPU.
17011	Executed task setting is illegal (event)	• Two or more fixed cycles of the event task have been set.		

MEMO

19.4 Multiple CPU Error Codes

19.4.1 Self-diagnosis error code

This section explains the self-diagnosis error code. A self-diagnosis error code is stored in D9008.
And, it can be confirmed with device monitor of the PC diagnosis/SW6RN-GSV☐P of GX Developer.
Each digit is defined as the error code as follows.


＊ ＊ ＊ ＊ ＊
Digit :
Tens digit :
Hundreds digit :
Details code
Thousands digit : Big classification (Factor)
Millions digit : Super classification (Except the PLC CPU)

Big classification	
1	Internal hardware
2	Handling
3	Parameter
4	Program
5	Watch timer
6	The correspondence which becomes double
7	Indicates Multiple CPU
8	—
9	Outside diagnosis

The characteristic error of Motion CPU is 10000 (the error code which occurs except the PLC CPU).

Table 19.8 Multiple CPU errors which occurs in the Motion CPU (1000 to 10000)

Middle classification	Error messages	Error code	Error information Classification code	Occurs CPU		LED status		Operating status of CPU	Diagnostic timing
				Single composition	Multiple composition	RUN	ERROR		
CPU (hard) error	MAIN CPU DOWN	1000	—	—	—	OFF	Flickers	Stop	Always
		1001							
		1002							
		1003							
		1004							
		1005							
		1006							
		1007							
		1008							
		1009							
	In the CPU, RAM error (RAM ERROR)	1105	—	○	○	OFF	Flickers	Stop	At power supply ON/at reset
	FUSE BREAK OFF	1300	—	—	—	OFF/ON	Flickers/ON	Stop/Continue (Note-7)	Always
Module error (hard)	SP. UNIT DOWN	1401	Module No.	○	○	OFF	Flickers	Stop	At power supply ON/at reset
Base	Q bus error (CONTROL-BUS ERROR)	1413	Module No.	○	○	OFF	Flickers	Stop	Always
		1414	Module No.	○	○	OFF	Flickers	Stop	Always
		1415	Base No. (Note-2)	○	◎	OFF	Flickers	Stop	Always
		1416	Module No. (Note-1)	—	◎	OFF	Flickers	Stop	At power supply ON/at reset
Power supply	Detection of AC/DC DOWN (AC/DC DOWN)	1500	—	○	○	ON	OFF	Continue	Always
Battery	(BATTERY ERROR)	1600	Drive name	○	○	ON	OFF	Continue	Always
		1601				BAT. ALM LED ON			
Handling the intelligent function module/ Multiple CPU module	Intelligent function module installation error (SP. UNIT LAY ERROR)	2121	Module No.	—	◎	OFF	Flickers	Stop	At power supply ON/at reset
		2124							
		2125							
		2126	Module No. (Note-1)						

(Note-1) : CPU No. is stored in slot No. of the common information classification.

(Note-2) : Base No. in "common information classification code" of "error information classification code" is 0 : CPU base, 1 to 7 : Number of extension bases.

(Note-3) : Because a stop error or CPU No. except CPU No. that it was reset becomes MULTI CPU DOWN simultaneously, a stop error or CPU No. except CPU No. that it was reset may store in the classification of error information depending on timing.

(Note-4) : When an error occurs in the Motion CPU and so on except PLC CPU, if a PC diagnosis is made in the CPU except PLC CPU from GX Developer via PLC CPU, the error code "10000" is indicated.

(Note-5) : The Motion SFC error detection signal (M2039) turned on at the error detection. A self-diagnosis error flag (M9008) and a diagnosis error flag (M9010) do not turn on at the error detection. The error code "10000" being set in D9008 is reset in the Motion SFC error detection signal (M2039) ON → OFF.

(Note-6) : MOTION RUN LED turns off at the stop error occurrence. (The condition of RUN LED does not change.)

(Note-7) : Operating status of CPU at the error occurrence can be set in the parameter. (LED display also changes continuously.)

Error code	Error contents and cause	Corrective action	Remark
1000	Run-away or failure of main CPU (1) Malfunctioning due to noise or other reason (2) Hardware fault	(1) Measure noise level. (2) Reset and establish the RUN status again. If the same error is displayed again, this suggests a CPU hardware error. Explain the error symptom and get advice from our sales representative.	
1001			
1002			
1003			
1004			
1005			
1006			
1007			
1008			
1009			
1105	Shared CPU memory fault in the CPU.	(1) Measure noise level. (2) Reset and establish the RUN status again. If the same error is displayed again, this suggests a CPU hardware error. Explain the error symptom and get advice from our sales representative.	
1300	There is an output module with a blown fuse.	Check ERR. LED of the output modules and replace the module whose LED is lit.	
1401	There was no response from the motion module or intelligent function module during initial communications.	The Motion dedicated module, the intelligent function module, the CPU module or the base unit has hardware error. Explain the error symptom and get advice from our sales representative.	
1413	An error is detected on the Q bus.	A special function module, the CPU module, or the base unit has hardware error. Explain the error symptom and get advice from our sales representative.	
1414			
1415	Fault of the CPU or extension base unit was detected.		
1416	Bus fault was detected at power-on or reset.		
1500	A momentary power interruption of the power supply occurred. The power supply went off.	Check the power supply.	
1600	(1) Voltage of the CPU has dropped below stipulated level. (2) The lead connector of CPU battery has not been installed.	(1) Replace the battery. (2) If the battery is for internal RAM or for the back-up power function, install a lead connector.	
1601	Battery voltage has dropped below stipulated level.	Replace the battery.	
2121	A CPU module is installed in a slot except CPU slot, 0 to 2 slot.	A CPU module is installed to a CPU slot or 0 to 2 slot.	
2124	(1) A module is installed in slot 65 or subsequent slot. (2) A module is installed in a base for which "None" is set in the base settings.	(1) Remove a module of slot 65 or subsequent slot. (2) Remove a module of base for which "None" is set in the base settings.	
2125	(1) A module which the PLC CPU cannot recognize has been installed. (2) There was no response from the intelligent function module.	(1) Install a usable module in the PLC CPU. (2) The intelligent function module has hardware error. Explain the error symptom and get advice from our sales representative.	
2126	CPU module locations in a Multiple CPU system is either of the following. (1) There are non-installation slots between the CPU modules. (2) The modules except the PLC CPU are installed between the PLC CPU modules.	(1) There must be non-installation slots between the CPU modules in the Multiple CPU system. (When the non-installation slots are reserved, cancel the reservation.) (2) Remove the modules except the PLC CPU installed between the PLC CPU modules, and shift over to the slots with the PLC CPU modules in the Multiple CPU system.	

○ : It occurs in the CPU (CPU No.) which detected a error.

◎ : It occurs in all CPU No. at the time of the Multiple CPU composition.

— : It does not occur.

Table 19.8 Multiple CPU errors which occurs in the Motion CPU (continued)

Middle classification	Error messages	Error code	Error information Classification code	Occurs CPU		LED status		Operating status of CPU	Diagnostic timing
				Single composition	Multiple composition	RUN	ERROR		
Parameter	PARAMETER ERROR	3001	File name	○	○	OFF	Flickers	Stop	At power supply ON/ at reset/ at Stop → Run
		3010		—	◎				
		3012		—	○				
		3013		—	◎				
Multiple CPU	Other issue opportunity CPU weight occasion error (MULTI CPU DOWN)	7000	Module No. (Note-1) (Note-3)	—	○	OFF	Flickers	Stop	Always
		7002	Module No. (Note-1)	—	○				At power supply ON/ at reset
		7003		—	○				
	Multiple CPU start error (MULTI EXE. ERROR)	7010	Module No. (Note-1)	—	○	OFF	Flickers	Stop	At power supply ON/ at reset
	Multiple CPU start error (MULTI CPU ERROR)	7020	Module No. (Note-1)	—	○	ON	ON	Continue	Always
CPU error except for PLC CPU	CPU error except for PLC CPU (CONT. UNIT ERROR) (Note-4) (Note-5)	10000	—	Except for PLC CPU		ON	ON : System setting error/ servo error OFF : other error	Stop : System setting error Continue : other error	At power supply ON/ at reset/ at Stop → Run

(Note-1) : CPU No. is stored in slot No. of the common information classification.

(Note-2) : Base No. in "common information classification code" of "error information classification code" is 0 : CPU base, 1 to 7 : Number of extension bases.

(Note-3) : Because a stop error or CPU No. except CPU No. that it was reset becomes MULTI CPU DOWN simultaneously, a stop error or CPU No. except CPU No. that it was reset may store in the classification of error information depending on timing.

(Note-4) : When an error occurs in the Motion CPU and so on except PLC CPU, if a PC diagnosis is made in the CPU except PLC CPU from GX Developer via PLC CPU, the error code "10000" is indicated.

(Note-5) : The Motion SFC error detection signal (M2039) turned on at the error detection. A self-diagnosis error flag (M9008) and a diagnosis error flag (M9010) do not turn on at the error detection. The error code "10000" being set in D9008 is reset in the Motion SFC error detection signal (M2039) ON → OFF.

(Note-6) : MOTION RUN LED turns off at the stop error occurrence. (The condition of RUN LED does not change.)

Error code	Error contents and cause	Corrective action	Remark
3001	Parameter contents have been destroyed.	(1) Read the error detailed information at the peripheral device, check and correct the parameter items corresponding to the numerical values (parameter No.). (2) If the error still occurred after correcting of the parameter settings, it may be an error for internal RAM of CPU or memory. Explain the error symptom and get advice from our sales representative.	
3010	The number of CPU modules set in the parameter differ from the real installation in a Multiple CPU system.	Match (preset count of Multiple CPU setting) – (CPU (empty) setting in I/O assignment) with the real installation of CPUs.	
3012	The reference CPU No. set in the parameter differ from the setting in a Multiple CPU system.	Match the setting in the parameter with that of the reference CPU No. (CPU No.1).	
3013	Multiple CPU automatic refresh setting is any of the followings in a Multiple CPU system. (1) When a bit device is used as a refresh device, a number except a multiple of 16 is set as the refresh first device. (2) A non-specifiable device is specified. (3) The number of transmitting points is an odd number.	Check the following in the Multiple CPU automatic refresh parameters and make correction. (1) When specifying the bit device, specify a multiple of 16 for the refresh first device. (2) Specify the device that may be specified for the refresh device. (3) Set the number of transmitting points to an even number.	
7000	In a Multiple CPU system, a CPU fault occurred at the CPU where "all station stop by stop error of CPU was selected" in the operating mode. (It occurs in the CPU except for the CPU that suspension of a system is chosen.)	Read the individual information of the error at the peripheral device, check the error of the CPU resulting in CPU fault, and remove the error.	
	In a Multiple CPU system, CPU No.1 resulted in stop error at power-on and the other CPU cannot start. (This error occurred at CPU No.2 to 4)		
7002	At initial communication in a Multiple CPU system, no response is given back from the target CPU of initial communication.	Reset the PLC CPU and run it again. If the same error is displayed again, it is a hardware fault of any CPU. Explain the error symptom and get advice from our sales representative.	
7003			
7010	(1) A fault CPU is installed in a Multiple CPU system. (2) CPUs of unmatched versions are installed in a Multiple CPU system. (This error is detected at the PLC CPU of function version B.) (3) Any CPU No. among CPU No.2 to 4 was reset, after power supply on a Multiple CPU system. (This error occurs at only the CPU No. which reset was released.)	The CPU No. of the function version A or the break down module is exchanged for the CPU module of the function version B, after it began to read the individual information of the error at the peripheral devices.	
7020	In a Multiple CPU system, a CPU fault occurred at the CPU where "all station stop by stop error of CPU was not selected" in the operation mode. (The error is detected at the PLC CPU of other than the CPU No. where the CPU fault occurred.)	Read the individual information of the error at the peripheral device, check the error of the CPU resulting in CPU fault, and remove the error.	
10000	The error which a Motion CPU was characteristic of occurred. It is set when an error all to set with the system setting error, the Motion CPU is detected. (Minor error, major error, servo error and various errors)	Use the software package of the applicable CPU module to check the details of the error that occurred.	

○ : It occurs in the CPU (CPU No.) which detected a error.
◎ : It occurs in all CPU No. at the time of the Multiple CPU composition.
— : It does not occur.

19.4.2 Release of self-diagnosis error

The CPU can perform the release operation for errors only when the errors allow the CPU to continue its operation.
To release the errors, follow the steps shown below.

(1) Eliminate the error cause.
(2) Store the error code to be released in the special register D9060.
(3) Turn the special relay M9060 off to on.
(4) The target error is released.

After the CPU is reset by the release of error, the special relays, special registers and LEDs for the error are returned to the states under which the error occurred.
If the same error occurs again after the release of the error, it will be registered again.

APPENDICES

APPENDIX 1 Processing Times

APPENDIX 1.1 Processing time of operation control/Transition instruction

(1) Operation instructions

Processing time of operation instruction

Classifications	Symbol	Instruction	Operation expression	Q173CPU(N)/Q172CPU(N) Unit [μs]
Binary operation	=	Substitution	#0=#1	6.30
			D800=D801	10.20
			#0L=#2L	8.70
			D800L=D802L	13.56
			#0F=#4F	8.88
			D800F=D804F	15.30
	+	Addition	#0=#1+#2	9.72
			D800=D801+D802	13.50
			#0L=#2L+#4L	11.52
			D800L=D802L+D804L	16.68
			#0F=#4F+#8F	13.26
			D800F=D804F+D808F	19.20
	-	Subtraction	#0=#1-#2	10.02
			D800=D801-D802	13.14
			#0L=#2L-#4L	10.68
			D800L=D802L-D804L	22.50
			#0F=#4F-#8F	12.06
			D800F=D804F-D808F	19.26
	*	Multiplication	#0=#1*#2	8.76
			D800=D801*D802	12.66
			#0L=#2L*#4L	8.46
			D800L=D802L*D804L	18.12
			#0F=#4F*#8F	12.30
			D800F=D804F*D808F	19.14
	/	Division	#0=#1/#2	10.08
			D800=D801/D802	13.02
			#0L=#2L/#4L	13.62
			D800L=D802L/D804L	20.52
			#0F=#4F/#8F	14.16
			D800F=D804F/D808F	20.04
	%	Remainder	#0=#1%#2	10.74
			D800=D801%D802	15.06
			#0L=#2L%#4L	13.20
			D800L=D802L%D804L	20.76
Bit operation	~	Bit inversion (complement)	#0=~#1	7.68
			D800=~D801	11.22
			#0L=~#2L	9.60
			D800L=~D802L	14.64

Processing time of operation instruction (Continued)

Classifications	Symbol	Instruction	Operation expression	Q173CPU(N)/Q172CPU(N) Unit [μs]
Bit operation	&	Bit logical AND	#0=#1&#2	3.78
			D800=D801&D802	12.78
			#0L=#2L&#4L	10.80
			D800L=D802L&D804L	18.24
	|	Bit logical OR	#0=#1|#2	8.40
			D800=D801|D802	12.36
			#0L=#2L|#4L	10.68
			D800L=D802L|D804L	12.54
	^	Bit exclusive OR	#0=#1^#2	8.76
			D800=D801^D802	10.80
			#0L=#2L^#4L	10.62
			D800L=D802L^D804L	15.60
	>>	Bit right shift	#0=#1>>#2	11.76
			D800=D801>>D802	15.00
			#0L=#2L>>#4L	11.82
			D800L=D802L>>D804L	18.06
	<<	Bit left shift	#0=#1<<#2	10.50
			D800=D801<<D802	12.24
			#0L=#2L<<#4L	12.18
			D800L=D802L<<D804L	15.90
Sign	-	Sign inversion (complement of 2)	#0=-#1	7.02
			D800=-D812	11.70
			#0L=-#2L	8.76
			D800L=-D802L	14.34
			#0F=-#4F	11.28
			D800F=-D804F	15.84
Standard function	SIN	Sine	#0F=SIN(#4F)	19.80
			D800F=SIN(D804F)	25.68
	COS	Cosin	#0F=COS(#4F)	13.20
			D800F=COS(D804F)	24.54
	TAN	Tangent	#0F=TAN(#4F)	19.86
			D800F=TAN(D804F)	30.78
	ASIN	Arcsin	#0F=ASIN(#4F)	21.18
			D800F=ASIN(D804F)	33.48
	ACOS	Arccosin	#0F=ACOS(#4F)	23.52
			D800F=ACOS(D804F)	34.80
	ATAN	Arctangent	#0F=ATAN(#4F)	15.30
			D800F=ATAN(D804F)	19.62
	SQRT	Square root	#0F=SQRT(#4F)	10.68
			D800F=SQRT(D804F)	15.42
	LN	Natural logarithm	#0F=LN(#4F)	16.92
			D800F=LN(D804F)	22.26
	EXP	Exponential operation	#0F=EXP(#4F)	18.54
			D800F=EXP(D804F)	25.14
	ABS	Absolute value	#0F=ABS(#4F)	12.90
			D800F=ABS(D804F)	16.02
	RND	Round-off	#0F=RND(#4F)	12.24
			D800F=RND(D804F)	12.42

Processing time of operation instruction (Continued)

Classifications	Symbol	Instruction	Operation expression	Q173CPU(N)/Q172CPU(N) Unit [μs]
Standard function	FIX	Round-down Round-up	#0F=FIX(#4F)	11.40
			D800F=FIX(D804F)	20.28
	FUP		#0F=FUP(#4F)	12.00
			D800F=FUP(D804F)	16.92
	BIN	BCD→BIN conversion	#0=BIN(#1)	8.82
			D800F=BIN(D801)	12.30
			#0L=BIN(#2L)	11.16
			D800L=BIN(D802L)	14.82
	BCD	BIN→BCD conversion	#0=BCD(#1)	13.92
			D800=BCD(D801)	17.70
			#0L=BCD(#2L)	14.94
			D800L=BCD(D802L)	26.10
Type conversion	SHORT	Converted into 16-bit integer type (signed)	#0=SHORT(#2L)	10.14
			#0=SHORT(#4F)	14.70
			D800=SHORT(D802L)	14.40
			D800=SHORT(D804F)	17.40
	USHORT	Converted into 16-bit integer type (unsigned)	#0=USHORT(#2L)	9.90
			#0=USHORT(#4F)	14.52
			D800=USHORT(D802L)	14.10
			D800=USHORT(D804F)	16.50
	LONG	Converted into 32-bit integer type (signed)	#0L=LONG(#2)	9.00
			#0L=LONG(#4F)	12.48
			D800L=LONG(D802)	12.90
			D800L=LONG(D804F)	18.60
	ULONG	Converted into 32-bit integer type (unsigned)	#0L=ULONG(#2)	9.30
			#0L=ULONG(#4F)	47.22
			D800L=ULONG(D802)	7.62
			D800L=ULONG(D804F)	50.10
	FLOAT	Regarded as signed data and converted into 64-bit floating point type	#0F=FLOAT(#4)	9.12
			#0F=FLOAT(#4L)	9.48
			D800F=FLOAT(D804)	13.56
			D800F=FLOAT(D804L)	15.00
	UFLOAT	UFLOAT Regarded as unsigned data and converted into 64-bit floating point type	#0F=UFLOAT(#4)	7.92
			#0F=UFLOAT(#4L)	10.26
			D800F=UFLOAT(D804)	13.26
			D800F=UFLOAT(D804L)	15.06
Bit device status	(None)	ON (normally open contact)	SET M1000 = M0	13.74
			SET M1000 = X100	14.26
			SET M1000 = PX0	14.82
	!	OFF (normally closed contact)	SET M1000 = !M0	13.38
			SET M1000 = !X100	14.40
			SET M1000 = !PX0	14.82
Bit device control	SET	Device set	SET M1000	3.42
			SET Y100	10.74
			SET PY0	14.58
	RST	Device reset	RST M1000	3.30
			RST Y100	10.02
			RST PY0	11.16

Processing time of operation instruction (Continued)

Classifications	Symbol	Instruction	Operation expression	Q173CPU(N)/Q172CPU(N) Unit [μs]
Bit device control	DOUT	Device output	DOUT M0,#0	9.42
			DOUT M0,#0L	10.14
			DOUT Y100,#0	9.48
			DOUT Y100,#0L	12.30
			DOUT PY0,#0	8.76
			DOUT PY0,#0L	15.48
	DIN	Device input	DIN #0,M0	8.88
			DIN #0L,M0	10.20
			DIN #0,X0	9.12
			DIN #0L,X0	9.66
			DIN #0,PX0	10.56
			DIN #0L,PX0	11.10
	OUT	Bit device output	OUT M1000 = M0	19.26
			OUT Y0 = M0	21.90
			OUT PY0 = M0	20.88
Logical operation	*	Logical AND	SET M1000 = M0*M1	15.96
			SET M1000 = X100*X101	14.70
			SET M1000 = PX0*PX1	17.40
	+	Logical OR	SET M1000 = M0+M1	15.66
			SET M1000 = X100+X101	14.94
			SET M1000 = PX0+PX1	16.20
Comparison operation	==	Equal to	SET M1000 = #0==#1	11.40
			SET M1000 = D800==D801	14.10
			SET M1000 = #0L==#2L	13.98
			SET M1000 = D800L==D802L	18.42
			SET M1000 = #0F==#4F	14.64
			SET M1000 = D800F==D804F	18.48
	!=	Not equal to	SET M1000 = #0!=#1	12.72
			SET M1000 = D800!=D801	15.24
			SET M1000 = #0L!=#2L	13.98
			SET M1000 = D800L!=D802L	18.54
			SET M1000 = #0F!=#4F	16.02
			SET M1000 = D800F!=D804F	18.66
	<	Less than	SET M1000 = #0<#1	10.56
			SET M1000 = D800<D801	16.14
			SET M1000 = #0L<#2L	16.26
			SET M1000 = D800L<D802L	18.78
			SET M1000 = #0F<#4F	16.32
			SET M1000 = D800F<D804F	16.32
	<=	Less than or equal to	SET M1000 = #0<=#1	12.60
			SET M1000 = D800<=D801	16.14
			SET M1000 = #0L<=#2L	14.04
			SET M1000 = D800L<=D802L	18.42
			SET M1000 = #0F<=#4F	16.50
			SET M1000 = D800F<=D804F	19.32

Processing time of operation instruction (Continued)

Classifications	Symbol	Instruction	Operation expression	Q173CPU(N)/Q172CPU(N) Unit [μs]
Comparison operation	>	More than	SET M1000 = #0>#1	12.18
			SET M1000 = D800>D801	15.72
			SET M1000 = #0L>#2L	14.64
			SET M1000 = D800L>D802L	19.74
			SET M1000 = #0F>#4F	15.30
			SET M1000 = D800F>D804F	19.86
	>=	More than or equal to	SET M1000 = #0>=#1	12.12
			SET M1000 = D800>=D801	15.84
			SET M1000 = #0L>=#2L	14.16
			SET M1000 = D800L>=D802L	19.38
			SET M1000 = #0F>=#4F	16.44
			SET M1000 = D800F>=D804F	21.84
Motion dedicated function	CHGV	Speed change request	CHGV(K1,#0)	13.80
			CHGV(K1,D800)	15.72
			CHGV(K1,#0L)	14.70
			CHGV(K1,D800L)	18.36
	CHGT	Torque limit value change request	CHGT(K1,#0)	6.84
			CHGT(K1,D800)	8.70
			CHGT(K1,#0L)	3.60
			CHGT(K1,D800L)	11.40
Others	EI	Event task enable	EI	3.78
	DI	Event task disable	DI	3.66
	NOP	No operation	NOP	1.44
	BMOV	Block transfer	BMOV #0,#100,K10	4.80
			BMOV D800,D100,K10	11.94
			BMOV #0,#100,K100	34.80
			BMOV D800,D100,K100	37.98
			BMOV N1,#0,K512	67.86
			BMOV N1,D800,K512	73.14
	FMOV	Same data block transfer	FMOV #0,#100,K10	13.98
			FMOV D800,D100,K10	21.18
			FMOV #0,#100,K100	25.50
			FMOV D800,D100,K100	43.80
	MULTW	Write device data to shared CPU memory of the self CPU	MULTW H800,#0,K1,M0	21.72
			MULTW H800,D800,K1,M0	22.14
			MULTW H800,#0,K10,M0	22.86
			MULTW H800,D800,K10,M0	28.92
			MULTW H800,D800,#0,K100,M0	42.36
			MULTW H800,D800,K100,M0	44.70
			MULTW H800,#0,K256,M0	81.06
			MULTW H800,D800,K256,M0	85.38

Processing time of operation instruction (Continued)

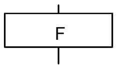
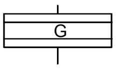
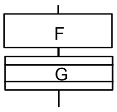
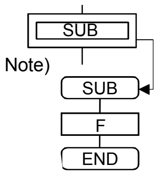
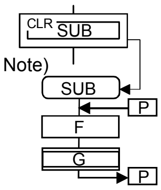
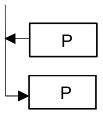
Classifications	Symbol	Instruction	Operation expression	Q173CPU(N)/Q172CPU(N) Unit [μs]
Others	MULTR	Read device data from shared CPU memory of the other CPU	MULTR #0,H3E0,H800,K1	44.16
			MULTR D800,H3E0,H800,K1	44.76
			MULTR H800,#0,K10,M0	51.48
			MULTR #0,H3E0,H800,K10	51.00
			MULTR D800,H3E0,H800,K10	134.88
			MULTR #0,H3E0,H800,K100	135.60
			MULTR #0,H3E0,H800,K256	269.94
			MULTR D800,H3E0,H800,K256	270.96
	TO	Write device data to intelligent function module/special function module	TO H0,H0,#0,K1	27.78
			TO H0,H0,D800,K1	27.30
			TO H0,H0,#0,K10	34.50
			TO H0,H0,D800,K10	34.80
			TO H0,H0,#0,K100	105.78
			TO H0,H0,D800,K100	120.90
			TO H0,H0,#0,K256	227.52
			TO H0,H0,D800,K256	249.24
	FROM	Read device data from intelligent	FROM #0,H0,H0,K1	31.20
			FROM D800,H0,H0,K1	28.14
			FROM #0,H0,H0,K10	36.30
			FROM D800,H0,H0,K10	37.44
			FROM #0,H0,H0,K100	119.70
			FROM D800,H0,H0,K100	116.82
			FROM #0,H0,H0,K256	247.98
			FROM D800,H0,H0,K256	246.90
	TIME	Time to wait	TIME K1	13.26
			TIME #0	19.50
			TIME D800	16.62

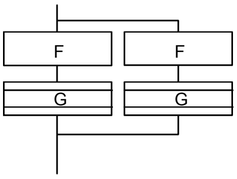
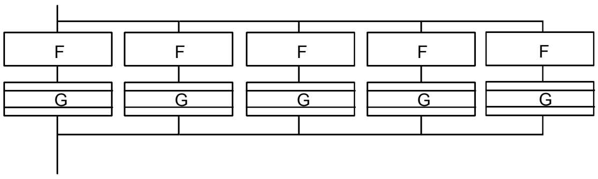
(2) Transition conditional expressions

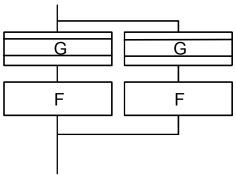
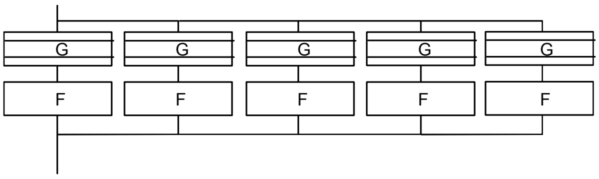
Processing time of transition conditional expressions

Classifications	Symbol	Instruction	Operation expression	Q173CPU(N)/Q172CPU(N) Unit [μs]
Bit device control	(None)	ON (Normally open contact) (When condition enables)	M0	2.82
			X100	6.88
			PX0	7.62
	!	OFF (Normally closed contact) (When condition enables)	!M0	3.24
			!X100	8.46
			!PX0	9.24
Logical operation	*	Logical AND	M0*M1	10.32
			X100*X101	11.28
			PX0*PX1	12.36
	+	Logical OR	M0+M1	5.28
			X100+X101	9.78
			PX0+PX1	11.10
Comparison operation	==	Equal to	#0==#1	1.26
			D800==D801	9.48
			#0L==#2L	7.74
			D800L==D802L	13.32
			#0F==#4F	9.36
			D800F==D804F	12.66
	!=	Not equal to	#0!=#1	1.38
			D800!=D801	9.42
			#0L!=#2L	8.16
			D800L!=D802L	12.06
			#0F!=#4F	9.60
			D800F!=D804F	12.24
	<	Less than	#0<#1	1.68
			D800<D801	9.90
			#0L<#2L	7.50
			D800L<D802L	12.48
			#0F<#4F	9.30
			D800F<D804F	13.80
	<=	Less than or equal to	#0<=#1	2.76
			D800<=D801	9.48
			#0L<=#2L	2.82
			D800L<=D802L	13.02
			#0F<=#4F	4.26
			D800<=D804F	11.40
	>	More than	#0>#1	6.48
			D800>D801	4.80
			#0L>#2L	7.98
			D800L>D802L	7.38
			#0F>#4F	9.12
			D800F>D804F	11.40
	>=	More than or equal to	#0>=#1	1.26
			D800>=D801	9.36
			#0L>=#2L	2.70
			D800L>=D802L	12.06
			#0F>=#4F	4.32
			D800F>=D804F	13.08

(3) Processing time by the combination F and G (program described in F/G is NOP)

	F alone	G alone	F+G	GSUB	CLR	JMP/coupling
						
Q173CPU(N)/ Q172CPU(N) [μs]	31.92	28.38	34.5	87.24	47.3	22.86

	Parallel branch (2 Pcs.)		Parallel branch (5 Pcs.)	
				
	At branch	At coupling	At branch	At coupling
Q173CPU(N)/ Q172CPU(N) [μs]	50.82	50.34	83.94	116.34

	Selective branch (2 Pcs.)	Selective branch (5 Pcs.)
		
Q173CPU(N)/ Q172CPU(N) [μs]	139.68	196.02

(Note) : Varies greatly with the started or cleared program.

POINT

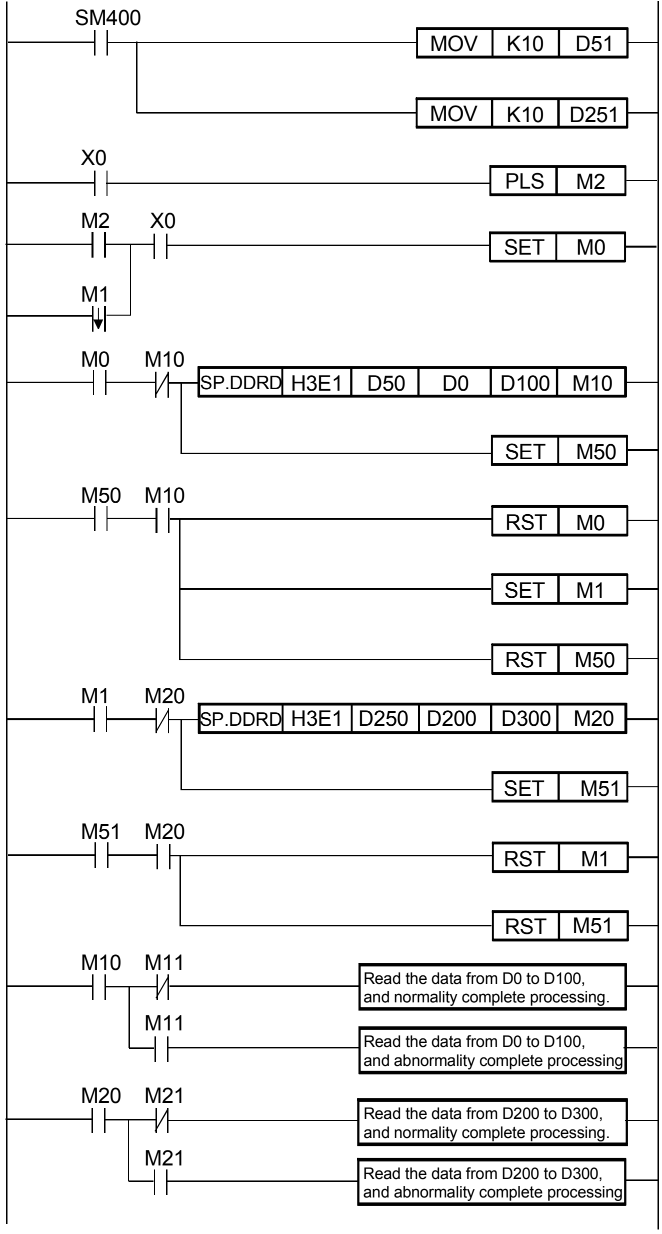
Long processing time may cause a Motion CPU WDT error or servo fault.
Especially for the Motion SFC programs run by event/NMI tasks, take care so that the processing time will not be too long.

APPENDIX 2 Sample Program

APPENDIX 2.1 Program example to execute the Multiple CPU dedicated instruction continuously

This is the program example which publishes the instruction continuously toward the same Motion CPU in the Multiple dedicated instruction toward the Motion CPU. When an instruction cannot be accepted even if it is executed, it becomes "No operation". The following is program example which repeats reading data for 10 points from D0 of the Motion CPU installing the CPU No.2 to since D100 of the PLC CPU, and the data for 10 points from D200 of the Motion CPU to since D300 of the PLC CPU by turns continuously during X0 is ON. Make a circuit to execute the next S(P).DDRD instruction after the device which it is made to turn on by the instruction completion of the S(P).DDRD instruction execute 1-scan turns it on.

<Example>


SM400
MOV K10 D51
MOV K10 D251
X0
PLS M2
M2 X0
SET M0
M1
M0 M10
SP.DDRD H3E1 D50 D0 D100 M10
SET M50
M50 M10
RST M0
SET M1
RST M50
M1 M20
SP.DDRD H3E1 D250 D200 D300 M20
SET M51
M51 M20
RST M1
RST M51
M10 M11
Read the data from D0 to D100, and normality complete processing.
M11
Read the data from D0 to D100, and abnormality complete processing
M20 M21
Read the data from D200 to D300, and normality complete processing.
M21
Read the data from D200 to D300, and abnormality complete processing

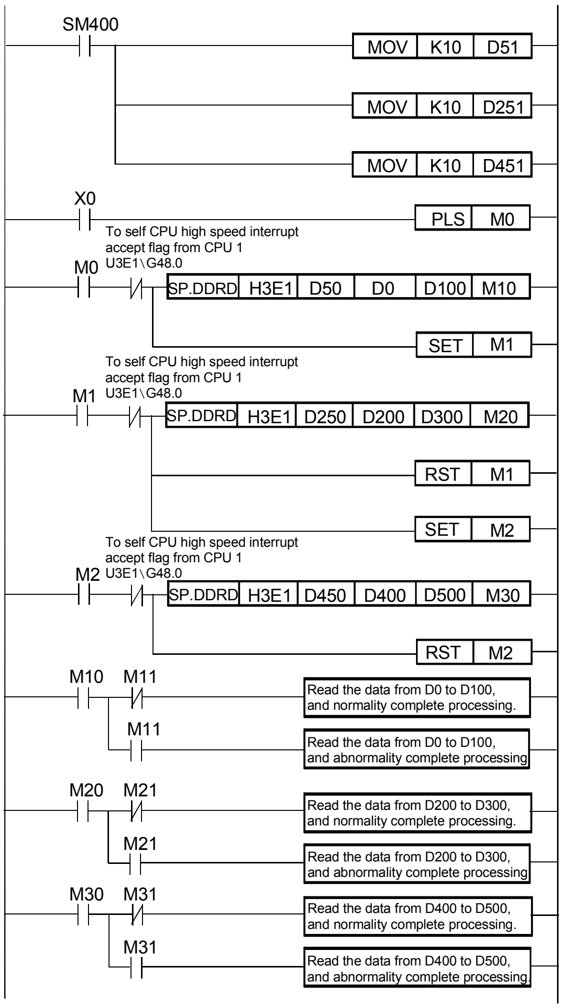
There is the following restriction in the case as an example.

1) The Multiple CPU instruction of Motion CPU cannot be used Interrupt program/fixed cycle executive type program and low speed executive type program. When it is used, an instruction may not operate by the timing.

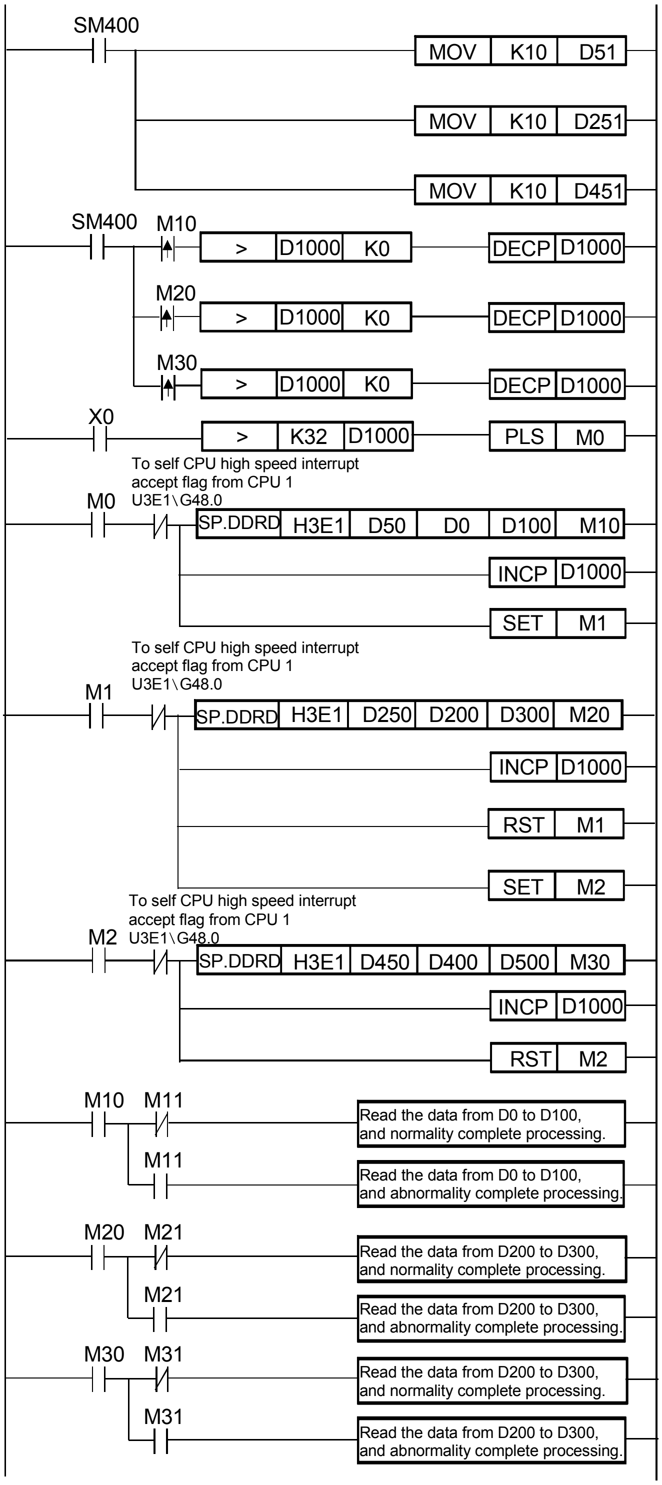
APPENDIX 2.2 The program example to execute plural Multiple CPU instruction by the instructions of one time

This is the program example which executes to the Multiple same Motion CPU at high speed by one instruction.
In this case, you must take an interlock with "To self CPU high speed interrupt accept flag from CPU". When an instruction cannot be accepted even if it is executed, it becomes "No operation".
The program which read the data for 10 points from D0 of the Motion CPU installing the CPU No.2 to since D100 of the PLC CPU, the data for 10 points from D200 of the Motion CPU to since D300 of the PLC CPU, and the data for 10 points from D400 of the Motion CPU to since D500 of the PLC CPU by starting of X0 is shown as an example 1.
At this time, number of multiple CPU dedicated execute instructions at one command should no exceed the maximum acceptable number of instructions (Refer to Chapter 5.) of one Motion CPU.
When an maximum acceptable number of instructions is 32, the program which made not to execute the multiple dedicated instructions when number of the Multiple CPU dedicated execute instructions exceeds 32 is shown as an example 2.

<Example 1>


SM400
MOV K10 D51
MOV K10 D251
MOV K10 D451
X0
PLS M0
To self CPU high speed interrupt accept flag from CPU 1
U3E1\G48.0
M0
SP.DDRD H3E1 D50 D0 D100 M10
SET M1
To self CPU high speed interrupt accept flag from CPU 1
U3E1\G48.0
M1
SP.DDRD H3E1 D250 D200 D300 M20
RST M1
SET M2
To self CPU high speed interrupt accept flag from CPU 1
U3E1\G48.0
M2
SP.DDRD H3E1 D450 D400 D500 M30
RST M2
M10 M11
Read the data from D0 to D100, and normality complete processing.
M11
Read the data from D0 to D100, and abnormality complete processing
M20 M21
Read the data from D200 to D300, and normality complete processing.
M21
Read the data from D200 to D300, and abnormality complete processing
M30 M31
Read the data from D400 to D500, and normality complete processing.
M31
Read the data from D400 to D500, and abnormality complete processing

<Example 2>


SM400
MOV K10 D51
MOV K10 D251
MOV K10 D451
SM400 M10
> D1000 K0
DECP D1000
M20
> D1000 K0
DECP D1000
M30
> D1000 K0
DECP D1000
X0
> K32 D1000
PLS M0
To self CPU high speed interrupt accept flag from CPU 1
M0 U3E1\G48.0
SP.DDRD H3E1 D50 D0 D100 M10
INCP D1000
SET M1
To self CPU high speed interrupt accept flag from CPU 1
M1 U3E1\G48.0
SP.DDRD H3E1 D250 D200 D300 M20
INCP D1000
RST M1
SET M2
To self CPU high speed interrupt accept flag from CPU 1
M2 U3E1\G48.0
SP.DDRD H3E1 D450 D400 D500 M30
INCP D1000
RST M2
M10 M11
Read the data from D0 to D100, and normality complete processing.
M11
Read the data from D0 to D100, and abnormality complete processing.
M20 M21
Read the data from D200 to D300, and normality complete processing.
M21
Read the data from D200 to D300, and abnormality complete processing.
M30 M31
Read the data from D200 to D300, and normality complete processing.
M31
Read the data from D200 to D300, and abnormality complete processing.

There is the following restriction in the case as the example 2.

1) The Multiple CPU dedicated instruction of Motion CPU cannot be used Interrupt program/fixed cycle executive type program and low speed executive type program. When it is used, an instruction may not work by the timing.

APPENDIX 2.3 Motion control example by Motion SFC program

(1) The Motion SFC program composition example to execute motion control.

This sample program example is described to every following function.

Function list of sample program

No.	Item	Description
1	Monitor of the positioning dedicated device	The positioning dedicated device status of the Motion CPU (CPU No.2) is reflected on "M2400 to" and "D0 to" of the PLC CPU (CPU No.1).
2	Reading of the clock data	The clock data read request (M9028) is turned on so that clock data may be set to the error history.
3	Forced stop	When the forced stop input assigned to PX0 is on, all axes turn on, and motion control is executed. When the forced stop input turn off, servo amplifier is made to forced stop, and motion control is suspended, and actual output (PY) turn off.
4	Motion control	Motion control is executed according to the condition of PX and PX2 in each following mode. • PX2 : OFF PX1 : OFF JOG mode • PX2 : OFF PX1 : ON Manual pulse generator mode • PX2 : On PX1 : OFF Home position return mode • PX2 : On PX1 : On Programming operation mode
5	JOG mode	The following JOG operation is executed when each signal of PX3 to PX6 is turned on. • PX3 : 1 axis JOG forward rotation • PX4 : 1 axis JOG reverse rotation • PX5 : 2 axes JOG forward rotation • PX6 : 2 axes JOG reverse rotation
6	Manual pulse generator mode	The following the manual pulse generator operation is executed. • Manual pulse generator operation of 1 axis is executed with the manual pulse generator P1. • Manual pulse generator operation of 2 axes is executed with the manual pulse generator P1.
7	Home position return mode	The following home position return is executed. • When PX3 is on, the home position return of 1 axis is executed. • When PX4 is on, the home position return of 2 axes is executed.
8	Programming operation mode	The following program operation is executed. • When PX3 detects OFF to ON, axis No.1 locates and 1000[ms] standing by, after the location of axis No.2 is executed. • When PX4 turn on, axis No.1, 2 locates of the linear control and in-position check is executed, after the location of axis No.2 is executed, the program stands by until No.1, 2 locates of the linear control is executed at a double speed in the opposition direction and PX4 turns off.

(2) Contents processing of the Motion SFC program

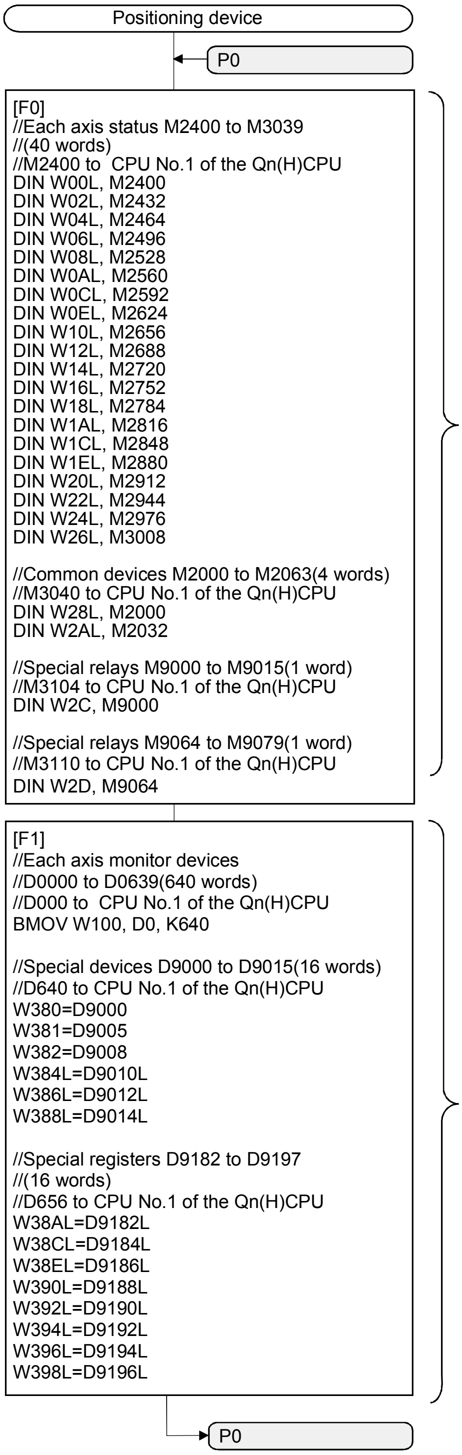
Motion SFC program list

No.	Program name	Task	Automatic operation	Number of connective transitions	Contents of processing
0	Positioning device	Normal	Start	3	• This program starts automatically at the time of run of Q173CPU(N), and it is always executed. • The positioning dedicated device (bit device) for monitor is transferred to "W0 to". • The positioning dedicated device (word device) for monitor is transferred to "W100 to". (Note) : "W0 to" is assigned to "M2400 to" of the PLC CPU (CPU No.1), and "W100 to" is assigned to "D0 to" by the automatic refresh setting.
20	Main	Normal	Start	3	• This program starts automatically at the time of run of Q173CPU(N), and it is always executed. • Watch data is taken out, and clock data read request (M9028) is turned on. • When a forced stop is canceled, a subroutine starts a "No.110 : Motion control". • "No.110 : Motion control" is stopped at the time of the forced stop, and real output (PY) is turned off.
110	Motion control	Normal	Not start	3	• All axes servo on. • The call of the subroutine of the following program is executed by the condition of PX1, PX2. 1) PX2 : OFF PX1 : OFF No.120 : JOG 2) PX2 : OFF PX1 : ON No.130 : Manual pulse generator 3) PX2 : ON PX1 : OFF No.140 : Home position return 4) PX2 : ON PX1 : ON No.150 : Programming operation
120	JOG	Normal	Not start	3	(1) The JOG operation speed of 1 axis and 2 axes is set. (2) 1 axis JOG forward command is turned on when PX3 is on, and the reverse command is turned on when PX4 is on. (3) 2 axes JOG forward command is turned on when PX5 is on, and the reverse command is turned on when PX6 is on. (4) The above (2), (3) are repeated during PX2/PX1 is off, when except for it, the JOG forward and reverse command of 1 axis and 2 axes are turned off and the program is ended.
130	Manual pulse generator	Normal	Not start	3	• 1 pulse input magnification of the 1 axis and 2 axes is set up. • 1 axis is controlled with P1, and set up to control 2 axes with P2, and Manual pulse generator enable flag of P1, P2 is turned on. • When except for PX2 : OFF, PX1 : ON (Manual pulse generator mode), Manual pulse generator enable flag of P1, P2 is turned off, and a program is ended.

Motion SFC program list (Continued)

No.	Program name	Task	Automatic operation	Number of connective transitions	Contents of processing
140	Home position return	Normal	Not start	3	• "K140 : The home position return of 1 axis" is started when PX3 is on,"K141 : The home position return of 2 axes" is started when PX4 is on. • PX2 : ON, PX1 : The program is ended when they become to except for off (Home position return mode).
150	Programming operation	Normal	Not start	3	• When PX3 detects OFF to ON, after positioning of 1 axis, standing by for 1000[ms] and positioning of 2 axes is executed. • When PX4 turn on, after positioning of linear interpolation in-position check is executed, positioning of axis No. 1, 2 linear interpolation is executed at a double speed in the opposition direction, and it stand by until PX4 turned off. • PX2 : ON, PX1 : The program is fended when they become to except for ON (Programming operation mode).

(a) No.0 : Positioning device



```
[F0]
//Each axis status M2400 to M3039
//(40 words)
//M2400 to  CPU No.1 of the Qn(H)CPU
DIN W00L, M2400
DIN W02L, M2432
DIN W04L, M2464
DIN W06L, M2496
DIN W08L, M2528
DIN W0AL, M2560
DIN W0CL, M2592
DIN W0EL, M2624
DIN W10L, M2656
DIN W12L, M2688
DIN W14L, M2720
DIN W16L, M2752
DIN W18L, M2784
DIN W1AL, M2816
DIN W1CL, M2848
DIN W1EL, M2880
DIN W20L, M2912
DIN W22L, M2944
DIN W24L, M2976
DIN W26L, M3008

//Common devices M2000 to M2063(4 words)
//M3040 to CPU No.1 of the Qn(H)CPU
DIN W28L, M2000
DIN W2AL, M2032

//Special relays M9000 to M9015(1 word)
//M3104 to CPU No.1 of the Qn(H)CPU
DIN W2C, M9000

//Special relays M9064 to M9079(1 word)
//M3110 to CPU No.1 of the Qn(H)CPU
DIN W2D, M9064
```

(1) Each axis status M2400 to M3039 (for 32 axes) transferred to "W0 to".
(2) Common devices M2000 to M2064 transferred to "W28 to".
(3) Special relay M9000 to M9015 transferred to "W2C to".

Automatic refresh of the between Multiple CPU, and "W0 to" of Q173CPU(N) (CPU No.2) sets it up to have refresh by "M2400 to" of Qn(H)CPU (CPU No.1), therefore the condition of Q173CPU(N) (CPU No.2) can be grasped with Qn(H)CPU of the CPU No.1 by monitoring the following device.

Devices of QnHCPU (CPU No.1)	Correspond with devices of Q173CPU(N) (CPU No.2)
M2400 to M3039	M2400 to M3039
M3040 to M3103	M2000 to M2064
M3104 to M3119	M9000 to M9015

(Note) : Refresh does data for 32 axes by this sample example, number of refresh points is made a necessary minimum corresponding to the system for processing time shortening.

```
[F1]
//Each axis monitor devices
//D0000 to D0639(640 words)
//D000 to  CPU No.1 of the Qn(H)CPU
BMOV W100, D0, K640

//Special devices D9000 to D9015(16 words)
//D640 to CPU No.1 of the Qn(H)CPU
W380=D9000
W381=D9005
W382=D9008
W384L=D9010L
W386L=D9012L
W388L=D9014L

//Special registers D9182 to D9197
//(16 words)
//D656 to CPU No.1 of the Qn(H)CPU
W38AL=D9182L
W38CL=D9184L
W38EL=D9186L
W390L=D9188L
W392L=D9190L
W394L=D9192L
W396L=D9194L
W398L=D9196L
```

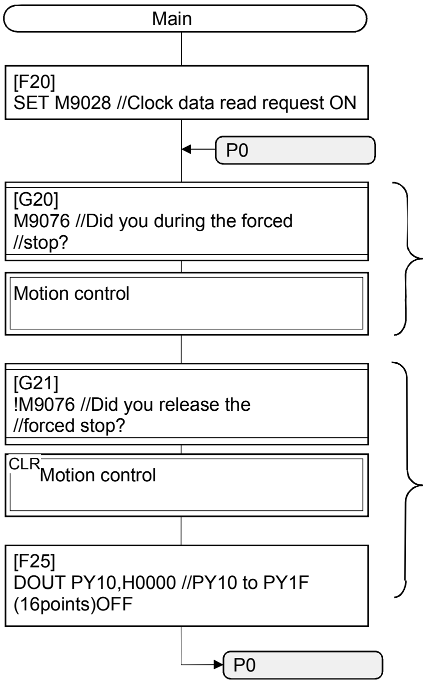
(1) Each monitor devices D0 to D639 (for 32 axes) transferred to "W100 to".
(2) Special register D9000 to D9015 transferred to "W380 to".
(3) Special register D9182 to M9197 transferred to "W38A to".

Automatic refresh of the between Multiple CPU, and "W100 to" of Q173CPU(N) (CPU No.2) sets it up to have refresh by "D0 to" of Qn(H)CPU (CPU No.1), therefore the condition of Q173CPU(N) (CPU No.2) can be grasped with Qn(H) CPU of the CPU No.1 by monitoring the following device.

Devices of QnHCPU (CPU No.1)	Correspond with devices of Q173CPU(N) (CPU No.2)
D0000 to D0639	D0000 to D0630
D0640 to D0655	D9000 to D9015
D0656 to D0671	D9182 to D9197

(Note) : Refresh does data for 32 axes by this sample example, number of refresh points is made a necessary minimum corresponding to the system for processing time shortening.

(b) No.20 : Main


Main
[F20]
SET M9028 //Clock data read request ON
P0
[G20]
M9076 //Did you during the forced
//stop?
Motion control
[G21]
!M9076 //Did you release the
//forced stop?
CLR
Motion control
[F25]
DOUT PY10,H0000 //PY10 to PY1F
(16points)OFF
P0

When a forced stop is released, a subroutine starts "No.110 : Motion control". (Because the next step is a shift, it becomes a subroutine start, and the next step is executed at the same time with subroutine practice, too.)

"No.110 : Motion control" is made to stop at the time of the forced stop, and (The program that a subroutine call is executed from No.110 stops, too.) actual output (PY) is turned off.

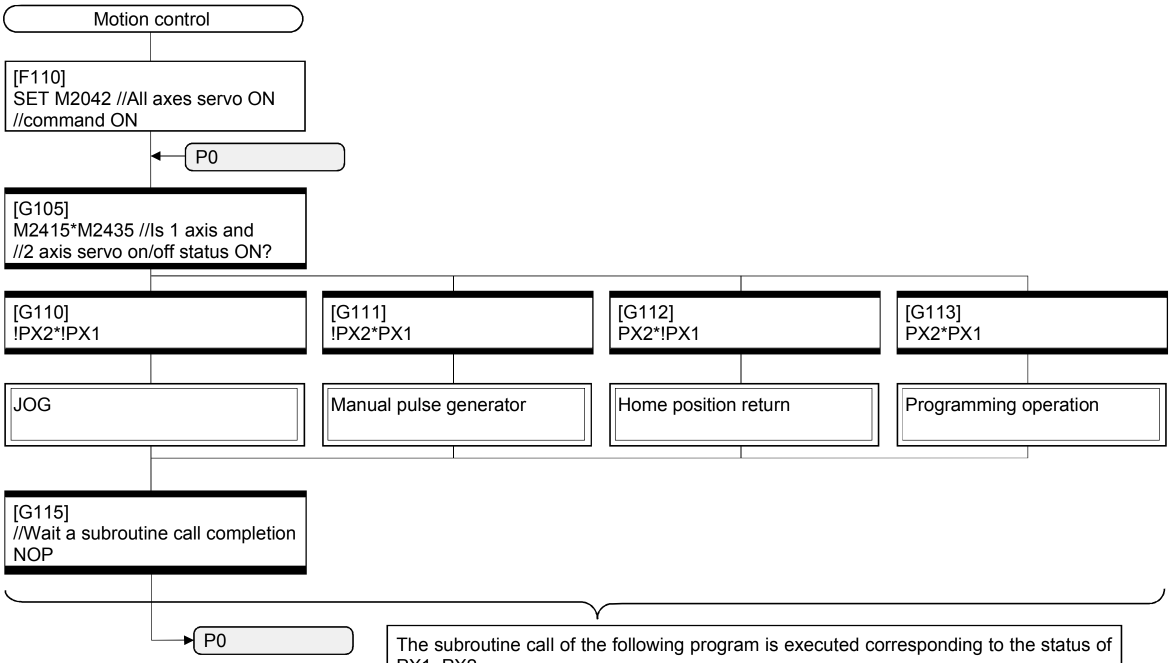
(Note-1) : The program that a subroutine was started is made to stop if necessary when a subroutine start program is added because it does not stop.

(Note-2) : Real output is turned off if necessary.

(Note-3) : The occurrence detection of servo error and so on is added to the stop status with forced stop if necessary.

When a forced stop is released, it is the structure which starts the program which does motion control from the initials again by sample program. Therefore it is the system example that motion control is resumed when a forced stop release is executed after it stops forced for while.

(c) No.110 : Motion control



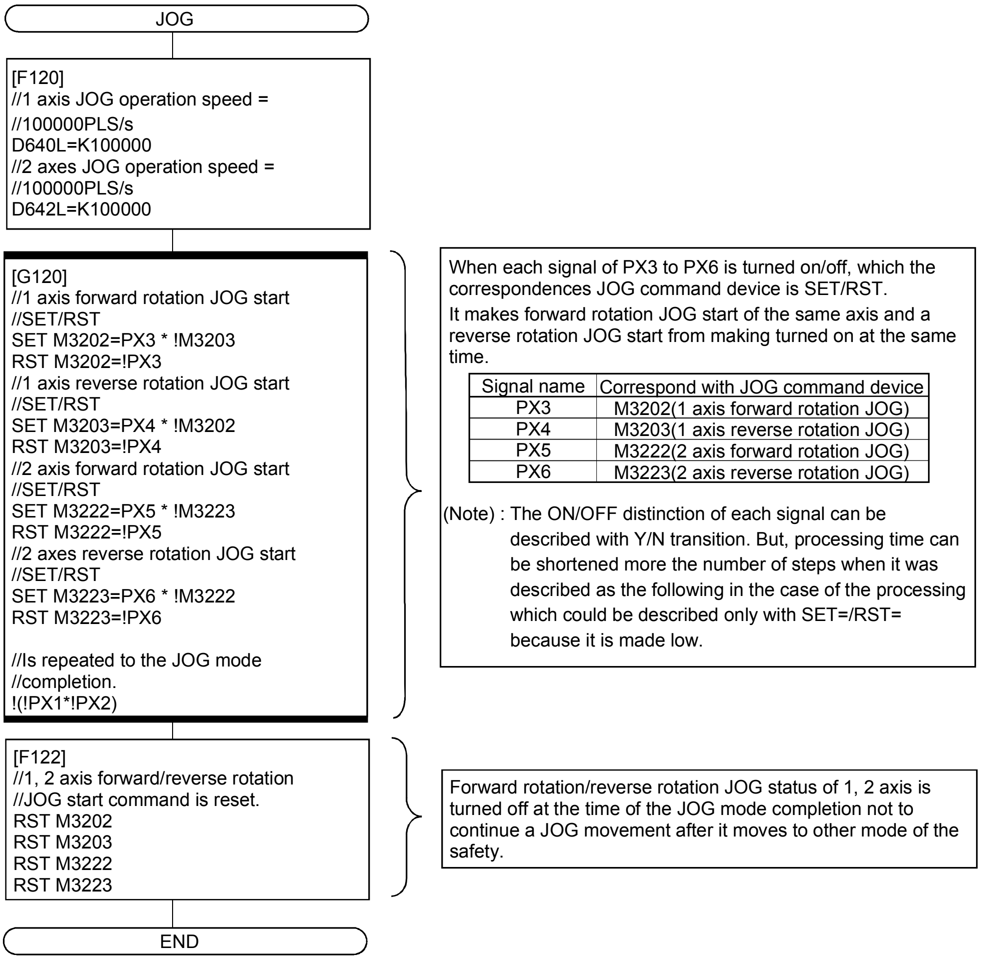
The subroutine call of the following program is executed corresponding to the status of PX1, PX2.

Selective branch is made the program so that each subroutine may never start it in the plural at the same time.

And, each subroutine makes the next step "WAIT" to become a subroutine call to make it stop when this program is suspended by the clear step of "No.20 : Main", too.

Condition of PX1, PX2		Subroutine call program	
PX2	PX1	No.	Program name
OFF	OFF	120	JOG
OFF	ON	130	Manual pulse generator
ON	OFF	140	Home position return
ON	ON	150	Programming operation

(d) No.120 : JOG



JOG

```
[F120]
//1 axis JOG operation speed =
//100000PLS/s
D640L=K100000
//2 axes JOG operation speed =
//100000PLS/s
D642L=K100000
```

```
[G120]
//1 axis forward rotation JOG start
//SET/RST
SET M3202=PX3 * !M3203
RST M3202=!PX3
//1 axis reverse rotation JOG start
//SET/RST
SET M3203=PX4 * !M3202
RST M3203=!PX4
//2 axis forward rotation JOG start
//SET/RST
SET M3222=PX5 * !M3223
RST M3222=!PX5
//2 axes reverse rotation JOG start
//SET/RST
SET M3223=PX6 * !M3222
RST M3223=!PX6

//Is repeated to the JOG mode
//completion.
!(!PX1*!PX2)
```

When each signal of PX3 to PX6 is turned on/off, which the correspondences JOG command device is SET/RST.

It makes forward rotation JOG start of the same axis and a reverse rotation JOG start from making turned on at the same time.

Signal name	Correspond with JOG command device
PX3	M3202(1 axis forward rotation JOG)
PX4	M3203(1 axis reverse rotation JOG)
PX5	M3222(2 axis forward rotation JOG)
PX6	M3223(2 axis reverse rotation JOG)

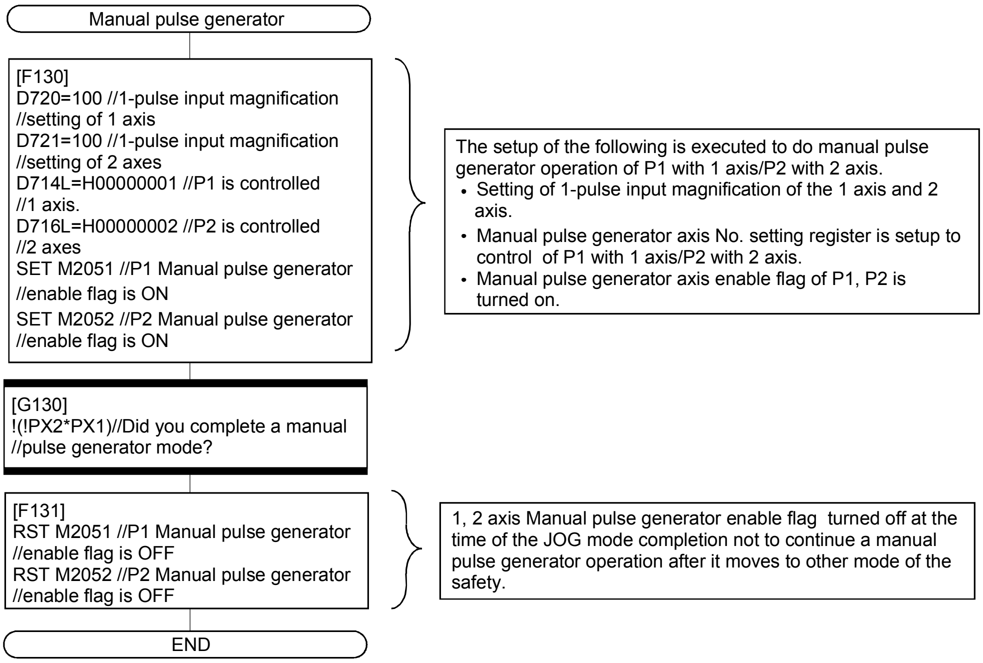
(Note) : The ON/OFF distinction of each signal can be described with Y/N transition. But, processing time can be shortened more the number of steps when it was described as the following in the case of the processing which could be described only with SET=/RST= because it is made low.

```
[F122]
//1, 2 axis forward/reverse rotation
//JOG start command is reset.
RST M3202
RST M3203
RST M3222
RST M3223
```

Forward rotation/reverse rotation JOG status of 1, 2 axis is turned off at the time of the JOG mode completion not to continue a JOG movement after it moves to other mode of the safety.

END

(e) No.130 : Manual pulse generator



Manual pulse generator

```
[F130]
D720=100 //1-pulse input magnification
//setting of 1 axis
D721=100 //1-pulse input magnification
//setting of 2 axes
D714L=H00000001 //P1 is controlled
//1 axis.
D716L=H00000002 //P2 is controlled
//2 axes
SET M2051 //P1 Manual pulse generator
//enable flag is ON
SET M2052 //P2 Manual pulse generator
//enable flag is ON
```

The setup of the following is executed to do manual pulse generator operation of P1 with 1 axis/P2 with 2 axis.

- Setting of 1-pulse input magnification of the 1 axis and 2 axis.
- Manual pulse generator axis No. setting register is setup to control of P1 with 1 axis/P2 with 2 axis.
- Manual pulse generator axis enable flag of P1, P2 is turned on.

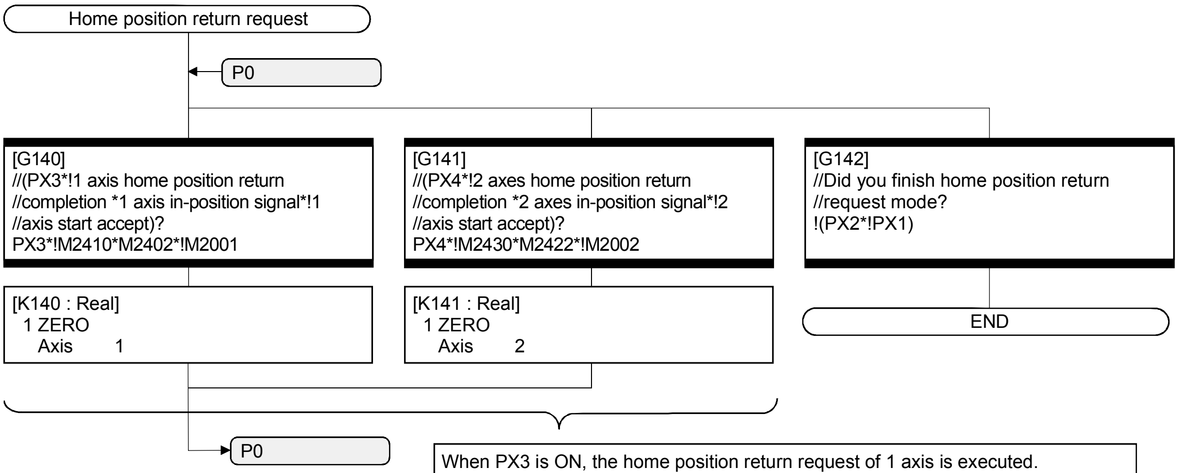
```
[G130]
!(!PX2*PX1)//Did you complete a manual
//pulse generator mode?
```

```
[F131]
RST M2051 //P1 Manual pulse generator
//enable flag is OFF
RST M2052 //P2 Manual pulse generator
//enable flag is OFF
```

1, 2 axis Manual pulse generator enable flag turned off at the time of the JOG mode completion not to continue a manual pulse generator operation after it moves to other mode of the safety.

END

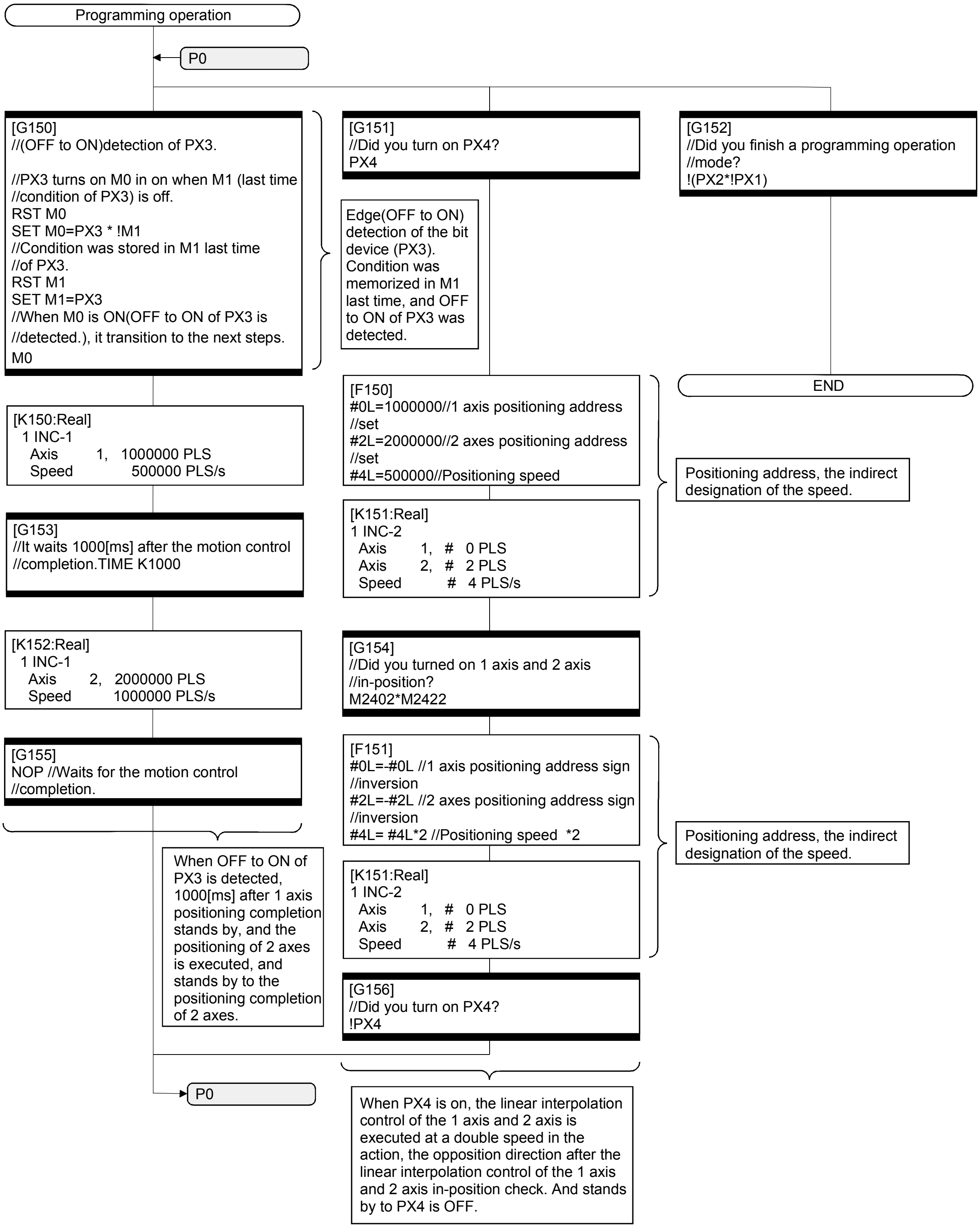
(f) No.140 : Home position return


Home position return request
P0
[G140]
//(PX3*!1 axis home position return
//completion *1 axis in-position signal*!1
//axis start accept)?
PX3*!M2410*M2402*!M2001
[G141]
//(PX4*!2 axes home position return
//completion *2 axes in-position signal*!2
//axis start accept)?
PX4*!M2430*M2422*!M2002
[G142]
//Did you finish home position return
//request mode?
!(PX2*!PX1)
[K140 : Real]
1 ZERO
Axis 1
[K141 : Real]
1 ZERO
Axis 2
END
P0

When PX3 is ON, the home position return request of 1 axis is executed.
When PX4 is ON, the home position return request of 2 axes is executed.
At this time in-position signal ON and start accept OFF confirmed, and home position return request program is started.

(Note) : This program is the structure which does not have WAIT that it waits for the completion of the home position return in the next of the motion control step, because it possible a thing during "K140" practice and "K141" are started.
(You must take the initial start of each axis to interlock condition to prevent the double start of K140 and K141.)

(g) No.150 : Programming operation



```
[G150]
//(OFF to ON)detection of PX3.

//PX3 turns on M0 in on when M1 (last time
//condition of PX3) is off.
RST M0
SET M0=PX3 * !M1
//Condition was stored in M1 last time
//of PX3.
RST M1
SET M1=PX3
//When M0 is ON(OFF to ON of PX3 is
//detected.), it transition to the next steps.
M0
```

Edge(OFF to ON) detection of the bit device (PX3). Condition was memorized in M1 last time, and OFF to ON of PX3 was detected.

```
[K150:Real]
 1 INC-1
  Axis       1,   1000000 PLS
  Speed            500000 PLS/s
```

```
[G153]
//It waits 1000[ms] after the motion control
//completion.TIME K1000
```

```
[K152:Real]
 1 INC-1
  Axis      2,   2000000 PLS
  Speed          1000000 PLS/s
```

```
[G155]
NOP //Waits for the motion control
//completion.
```

When OFF to ON of PX3 is detected, 1000[ms] after 1 axis positioning completion stands by, and the positioning of 2 axes is executed, and stands by to the positioning completion of 2 axes.

```
[G151]
//Did you turn on PX4?
PX4
```

```
[F150]
#0L=1000000//1 axis positioning address
//set
#2L=2000000//2 axes positioning address
//set
#4L=500000//Positioning speed
```

```
[K151:Real]
1 INC-2
 Axis       1,  #   0 PLS
 Axis       2,  #   2 PLS
 Speed          #   4 PLS/s
```

Positioning address, the indirect designation of the speed.

```
[G154]
//Did you turned on 1 axis and 2 axis
//in-position?
M2402*M2422
```

```
[F151]
#0L=-#0L //1 axis positioning address sign
//inversion
#2L=-#2L //2 axes positioning address sign
//inversion
#4L= #4L*2 //Positioning speed  *2
```

```
[K151:Real]
1 INC-2
 Axis       1,  #   0 PLS
 Axis       2,  #   2 PLS
 Speed          #   4 PLS/s
```

Positioning address, the indirect designation of the speed.

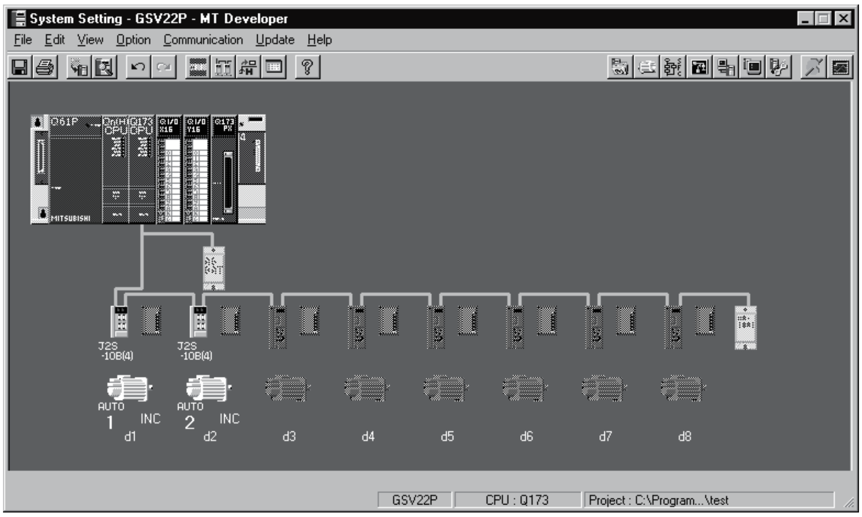
```
[G156]
//Did you turn on PX4?
!PX4
```

When PX4 is on, the linear interpolation control of the 1 axis and 2 axis is executed at a double speed in the action, the opposition direction after the linear interpolation control of the 1 axis and 2 axis in-position check. And stands by to PX4 is OFF.

```
[G152]
//Did you finish a programming operation
//mode?
!(PX2*!PX1)
```

(3) System setting data of the Motion CPU

System setting is shown below.



(a) Module setting

Manual pulse generator interface module (Q173PX : Slot 3)

Axis No.	Description
P1	Manual pulse generator, Synchronous encoder (INC)
P2	Manual pulse generator, Synchronous encoder (INC)
P3	Manual pulse generator, Synchronous encoder (INC)
I/O response time	0.4[ms]

(b) Basic setting

1) Multiple CPU setting

Setting items	Description
Number of Multiple CPU	2 modules
Operating mode	All CPU stop by stop error of CPU No.1/2

2) Automatic refresh setting 1

CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. starting	W0
	Point	Start	End	Start	End
No.1	0	—	—	—	—
No.2	50	0800	0831	W0	W31
No.3					
No.4					

This device area is set up in "M2400" with the Qn(H) CPU No.1. (The bit device for monitor is transferred to "W0 to" by the Motion SFC program on the Q173CPU(N) side.).

3) Automatic refresh setting 2

CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. starting	W100
	Point	Start	End	Start	End
No.1	0	—	—	—	—
No.2	640	0832	0AB1	W100	W37F
No.3					
No.4					

This device area is set up in "D0" with the Qn (H) CPU No.1. (The ward device for monitor is transferred to "W100" to by the Motion SFC program on the Q173CPU(N) side.).

4) Automatic refresh setting 3

CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. starting	
	Point	Start	End	Start	End
No.1					
No.2					
No.3					
No.4					

5) Automatic refresh setting 4

CPU	Send range for each CPU			CPU side device	
	CPU share memory G			Dev. starting	
	Point	Start	End	Start	End
No.1					
No.2					
No.3					
No.4					

This setting area is used for the use except for the positioning device for the monitor.

6) System setting

Setting items	Description
Operation cycle setting	Auto
Operation mode	M2000 is turned on with switch (Stop to Run)
Emergency shout down input	PX0

7) Latch range setting

Item	Symbol	Latch (1)		Latch (2)	
		Start	End	Start	End
Internal relay	M				
Link relay	B				
Annunciator	F				
Data register	D				
Link register	W				

Latch (1) : It is possible to clear using the latch clear.

Latch (2) : Clearing using the latch clear is disabled.

(c) PLC module setting

Type of the module	Number of points	Occupation device	Base	Slot No.	I/O response time
Input	16	000-00F	CPU base unit	1	10[ms]
Output	16	010-01F	CPU base unit	2	

(4) Parameter setting of the Qn(H) CPU No.1

PC parameter item			Qn(H) parameter				
			Description				
1	Number of CPU		2 modules				
2	Operation mode		The error operating mode in the CPU stop.				
		CPU No.1	All station stop by stop error				
		CPU No.2	All station stop by stop error				
3	Out of group input settings		The input condition outside the group is taken.				
	Out of group output settings		The output condition outside the group is not taken.				
4	Refresh setting						
	Setting No.1 CPU		Send range for each CPU			CPU side device	
			Shared CPU memory G			First device	M2400
			Point	Start	End	Start	END
		CPU No.1	0	—	—	—	—
		CPU No.2	50	0800	0831	M2400	M3199
	Setting No.2 CPU		Send range for each CPU			CPU side device	
			Shared CPU memory G			First device	D0
			Point	Start	End	Start	END
		CPU No.1	0	—	—	—	—
		CPU No.2	640	0832	0AB1	D0	D639

APPENDIX 2.4 Continuation execution example at the subroutine re-start by the Motion SFC program

(1) Explanation of the operation

This is the program example which execute continuously from the motion control step which stopped on the way when it re-started after stopping the subroutine program with the clear step during the motion control is running.

The servo is turned on by the forced stop release and the positioning control of the 2 axes liner interpolation is executed when PX4 is ON in this program. One cycle operation is completed after confirmation that PX4 became OFF. When the forced stop is executed during the positioning operating, the positioning operation is interrupted and the servomotor is stopped. It is resumed from the interrupted positioning operation when the forced stop was released next.
Continuation execution of the subroutine re-start is executed by this program example by the following processing.

(a) While motion control with the subroutine is executed, it is memorized whether the positioning of which motion control step was completed in the user device.

(b) The subroutine re-start is resumed from the motion control step of stopping the information memorized by the above (a).

(c) A motion control step should locate absolute to cope with it when it is resumed after it stops on the way of the positioning.

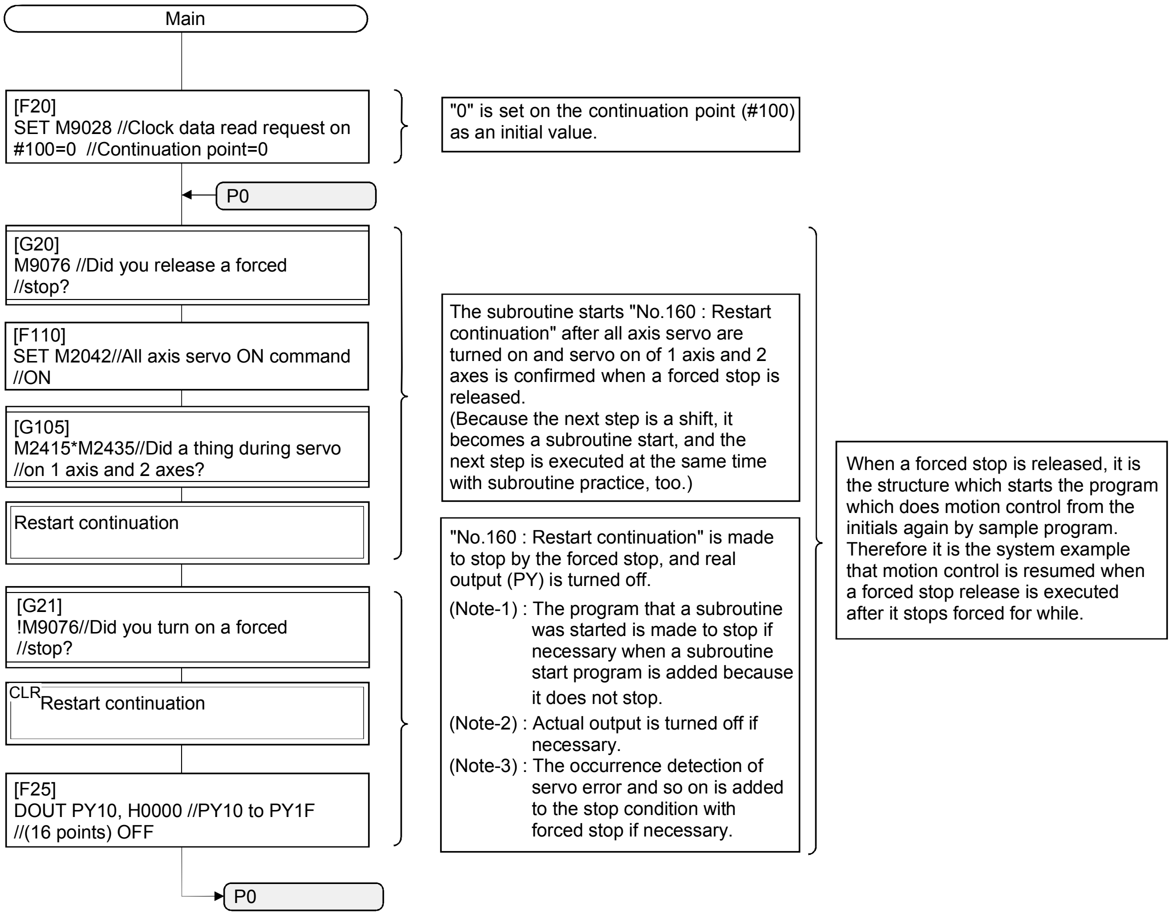
(d) A positioning complete signal (M2401+20n) is used for the decision, whether servomotor is stopped during the positioning.

(2) Contents of processing the Motion SFC program

Motion SFC program list

<table>
<tr><th>No.</th><th>Program name</th><th>Task</th><th>Automatic operation</th><th>Number of connective transitions</th><th>Contents of processing</th></tr>
<tr><td>20</td><td>Main</td><td>Normal</td><td>Start</td><td>3</td><td>• This program starts automatically at the time of RUN of Q173CPU(N), and it is always executed.
• Watch data is taken out, and clock data read request (M9028) is turned on.
• "0" is set on the continuation point (#100 : user device) as an initial value.
• The subroutine starts a "No.160 : Re-start continuation" after all axes servo are turned on and servo on of 1 axis and 2 axes is confirmed when a forced stop is released.
• "No.160 : Re-start continuation" is stopped at the time of the forced stop, and actual output (PY) is turned off.</td></tr>
<tr><td>160</td><td>Restart continuation</td><td>Normal</td><td>Not start</td><td>3</td><td>(1) This program jumps corresponding to the value of the continuation point (#100) of the following (2) 1) to 9).
<table>
<tr><th>#100</th><th>Jump destination</th></tr>
<tr><td>0</td><td>Following (2) 1)</td></tr>
<tr><td>10</td><td>Following (2) 3)</td></tr>
<tr><td>20</td><td>Following (2) 5)</td></tr>
<tr><td>30</td><td>Following (2) 8)</td></tr>
</table>
(2) The following motion control is executed.
1) This program stands by until PX4 is turned on.
2) "10" is set on continuation point (#100).
3) 1 axis, 2 axes are located in (0,0) in the linear control (absolute 2 axes positioning).
4) Positioning completion signal on of 1 axis, 2 axes is confirmed, and "20" is set on the continuation point (#100).
5) In-position on of 1 axis and 2 axes is confirmed.
6) 1 axis, 2 axes are located in (1000000, 2000000) in the linear control (absolute 2 axes positioning).
7) Positioning completion signal on of 1 axis, 2 axes is confirmed, and "30" is set on the continuation point (#100).
8) This program stands by until PX4 is turned off.
9) "0" is set on continuation point (#100).</td></tr>
</table>

(a) No.20 : Main


Main
[F20]
SET M9028 //Clock data read request on
#100=0 //Continuation point=0
P0
[G20]
M9076 //Did you release a forced
//stop?
[F110]
SET M2042//All axis servo ON command
//ON
[G105]
M2415*M2435//Did a thing during servo
//on 1 axis and 2 axes?
Restart continuation
[G21]
!M9076//Did you turn on a forced
//stop?
CLR Restart continuation
[F25]
DOUT PY10, H0000 //PY10 to PY1F
//(16 points) OFF
P0

"0" is set on the continuation point (#100) as an initial value.

The subroutine starts "No.160 : Restart continuation" after all axis servo are turned on and servo on of 1 axis and 2 axes is confirmed when a forced stop is released.
(Because the next step is a shift, it becomes a subroutine start, and the next step is executed at the same time with subroutine practice, too.)

"No.160 : Restart continuation" is made to stop by the forced stop, and real output (PY) is turned off.

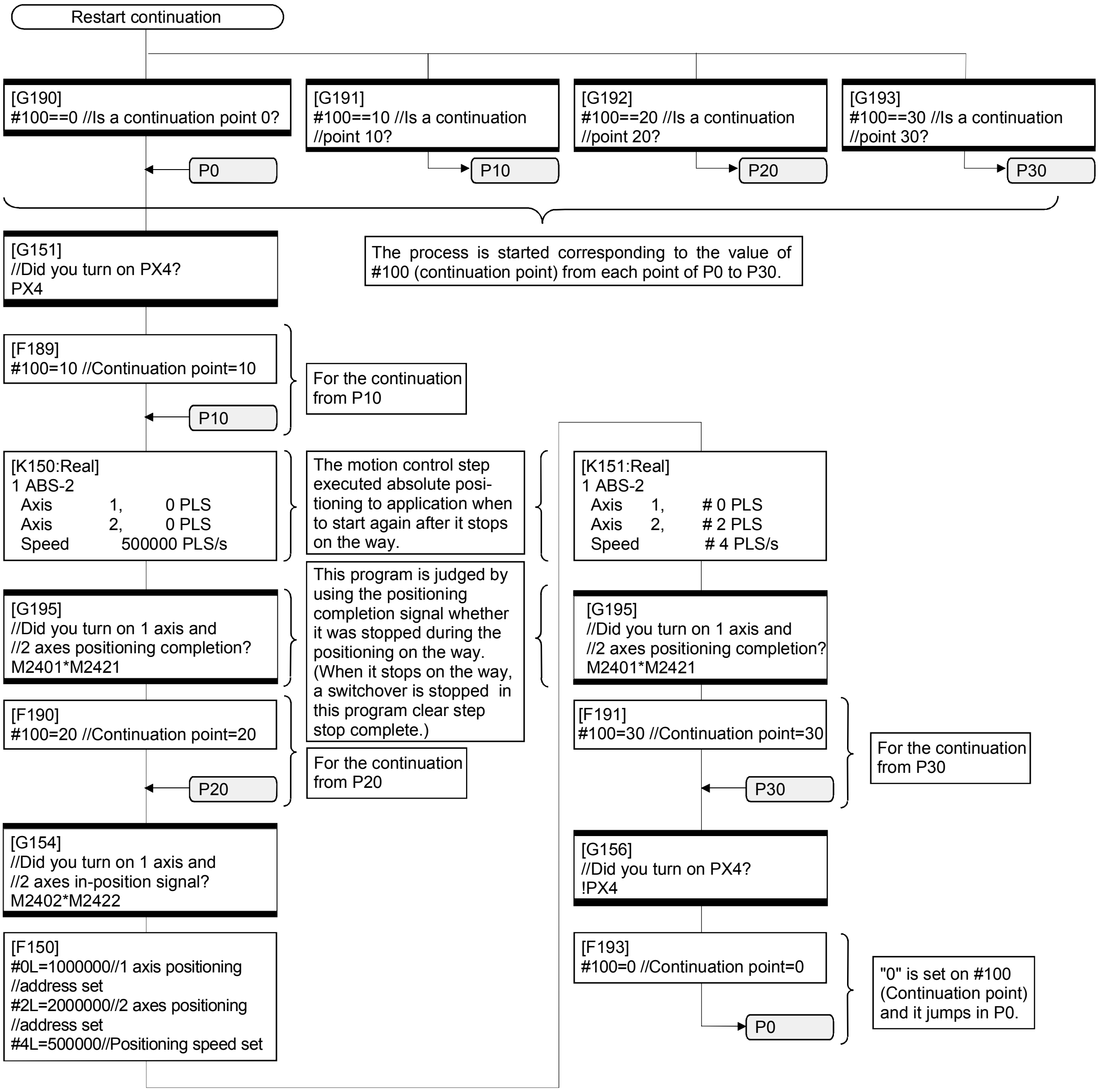
(Note-1) : The program that a subroutine was started is made to stop if necessary when a subroutine start program is added because it does not stop.

(Note-2) : Actual output is turned off if necessary.

(Note-3) : The occurrence detection of servo error and so on is added to the stop condition with forced stop if necessary.

When a forced stop is released, it is the structure which starts the program which does motion control from the initials again by sample program. Therefore it is the system example that motion control is resumed when a forced stop release is executed after it stops forced for while.

(b) No.160 : Restart continuation


Restart continuation
[G190]
#100==0 //Is a continuation point 0?
[G191]
#100==10 //Is a continuation
//point 10?
[G192]
#100==20 //Is a continuation
//point 20?
[G193]
#100==30 //Is a continuation
//point 30?
P0
P10
P20
P30
The process is started corresponding to the value of #100 (continuation point) from each point of P0 to P30.
[G151]
//Did you turn on PX4?
PX4
[F189]
#100=10 //Continuation point=10
P10
For the continuation from P10
[K150:Real]
1 ABS-2
Axis 1, 0 PLS
Axis 2, 0 PLS
Speed 500000 PLS/s
The motion control step executed absolute positioning to application when to start again after it stops on the way.
[K151:Real]
1 ABS-2
Axis 1, # 0 PLS
Axis 2, # 2 PLS
Speed # 4 PLS/s
[G195]
//Did you turn on 1 axis and
//2 axes positioning completion?
M2401*M2421
This program is judged by using the positioning completion signal whether it was stopped during the positioning on the way. (When it stops on the way, a switchover is stopped in this program clear step stop complete.)
[G195]
//Did you turn on 1 axis and
//2 axes positioning completion?
M2401*M2421
[F190]
#100=20 //Continuation point=20
P20
For the continuation from P20
[F191]
#100=30 //Continuation point=30
P30
For the continuation from P30
[G154]
//Did you turn on 1 axis and
//2 axes in-position signal?
M2402*M2422
[G156]
//Did you turn on PX4?
!PX4
[F150]
#0L=1000000//1 axis positioning
//address set
#2L=2000000//2 axes positioning
//address set
#4L=500000//Positioning speed set
[F193]
#100=0 //Continuation point=0
P0
"0" is set on #100 (Continuation point) and it jumps in P0.

APPENDIX 2.5 Continuation execution example after the stop by the Motion SFC program

(1) The explanation of the operation

The program example that the Motion SFC program is stopped by external input signal ON for the forced stop from the input module, and it is executed continuously by external signal OFF for the stop is shown below.

The servo is turned on by the forced stop release and the positioning control of the 2 axes liner interpolation is executed when PX4 is ON in this program. One cycle operation is completed after confirmation that PX4 became OFF.
When PX5 turns ON during the positioning operating, the positioning operation is stopped by the stop instruction and it is resumed from the interrupted positioning operation at turning PX5 on. The transition to the next step is not executed during PX5 is ON in the WAIT transition.
When the forced stop is executed during the positioning operating, the positioning operation is interrupted and the servomotor is stopped. It is resumed from the interrupted positioning operation when the forced stop was released next.
Continuation execution of the stop and stop after is executed by this program example by the following processing.

(a) While PX5 turns it on, it is made to turn on a stop command (M3200+20n) and an internal relay (M100) for the stop.

(b) While PX5 turns it off, it is made to turn off a stop command (M3200+20n) and an internal relay (M100) for the stop.

(c) A motion control step does absolute position to cope with it when it is resumed after it stops on the way of the positioning.

(d) A positioning completion signal (M2401+20n) is used for the decision whether it is stopped during the positioning on the way.

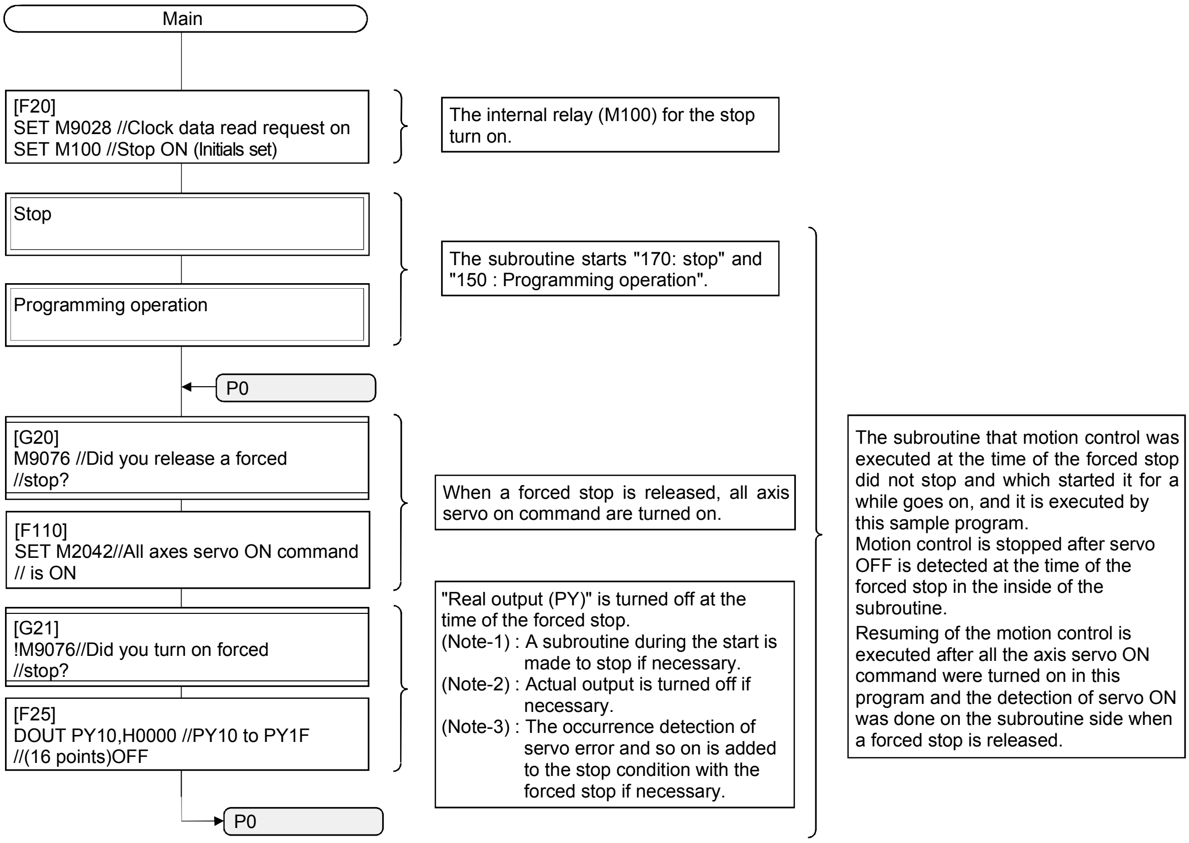
(e) The motion control step is resumed after it waits to turn it off, when it was stepped during positioning.

(f) "The internal relay (M100) for the stop turn off." is substituted for the WAIT transition condition that you must stop.

(2) Contents of processing SFC program
SFC program list

No.	Program name	Task	Automatic operation	Number of connective transitions	Contents of processing
20	Main	Normal	Start	3	• This program starts automatically at the time of RUN of Q173CPU(N), and it is always executed. • Watch data is taken out, and clock data read request (M9028) is turned on. • The initials condition of the internal relay (M100) for the stop is turned on. • The subroutine starts "No.170 : Stop". • The subroutine starts "No.150 : Programming operation". • When an forced stop is released, all axes servo are turned on. • Turns off actual output (PY) at the time of the forced stop.
170	Stop	Normal	Not start	3	(1) When a stop input signal (PX5) from the input unit is off, the treatment of the following (2) is executed, and 1 axis and 2 axes executed the following (3) during servo on in the case of the one except for it. (2) 1 axis and 2 axes stop command are turned off, and an internal relay (M100) for the stop is turned off. (3) 1 axis and 2 axes stop command are turned on, and an internal relay (M100) for the stop is turned on.
150	Program operation	Normal	Not start	3	(1) The following motion control is executed. 1) This program stands by until PX4 is turned on. 2) 1 axis and 2 axes are located in (0,0) in the linear interpolation control (absolute 2 axes positioning). 3) Positioning completion signal on of 1 axis and 2 axes are confirmed. 4) In-position on of 1 axis and 2 axes are confirmed. 5) 1 axis and 2 axes are located in (1000000, 2000000) in the linear control (absolute 2 axes positioning). 6) Positioning completion signal on of 1 axis and 2 axes are confirmed. 7) This program stands by until PX4 is turned off. (2) When a positioning completion signal of the above (1) 3) and 6) is off, it waits to turn off, and (When a positioning was suspended on the way.) execute the motion control step (1) 2) or 5) again. (3) Until an internal relay (M100) for the stop turns it on, it does not move to the next step of the above (1) 1) and 7).

(a) No.20 : Main



[F20]
SET M9028 //Clock data read request on
SET M100 //Stop ON (Initials set)

The internal relay (M100) for the stop turn on.

The subroutine starts "170: stop" and "150 : Programming operation".

[G20]
M9076 //Did you release a forced
//stop?

[F110]
SET M2042//All axes servo ON command
// is ON

When a forced stop is released, all axis servo on command are turned on.

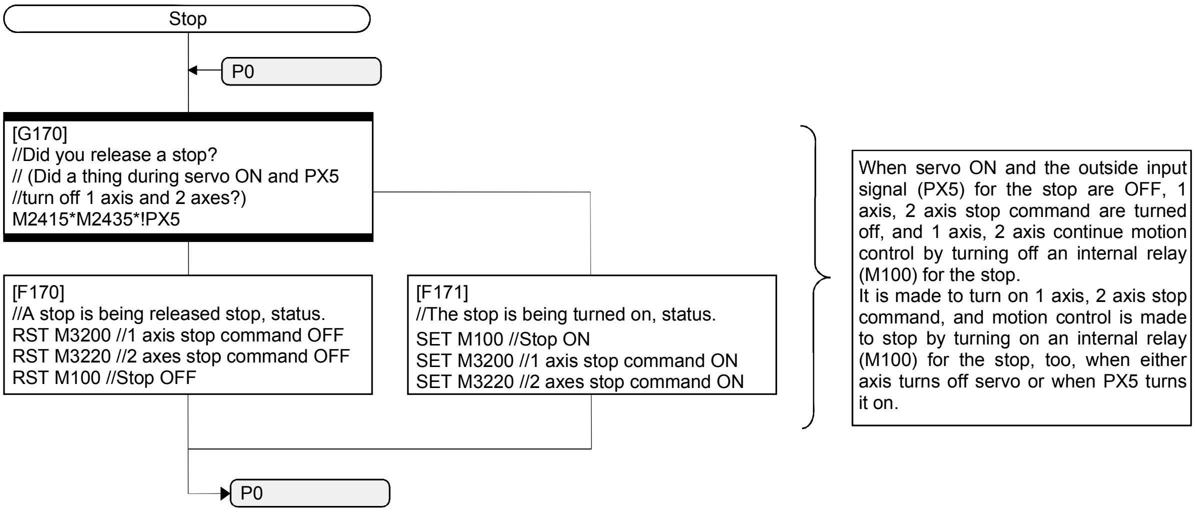
[G21]
!M9076//Did you turn on forced
//stop?

[F25]
DOUT PY10,H0000 //PY10 to PY1F
//(16 points)OFF

"Real output (PY)" is turned off at the time of the forced stop.
(Note-1) : A subroutine during the start is made to stop if necessary.
(Note-2) : Actual output is turned off if necessary.
(Note-3) : The occurrence detection of servo error and so on is added to the stop condition with the forced stop if necessary.

The subroutine that motion control was executed at the time of the forced stop did not stop and which started it for a while goes on, and it is executed by this sample program.
Motion control is stopped after servo OFF is detected at the time of the forced stop in the inside of the subroutine.
Resuming of the motion control is executed after all the axis servo ON command were turned on in this program and the detection of servo ON was done on the subroutine side when a forced stop is released.

(b) No.170 : Stop



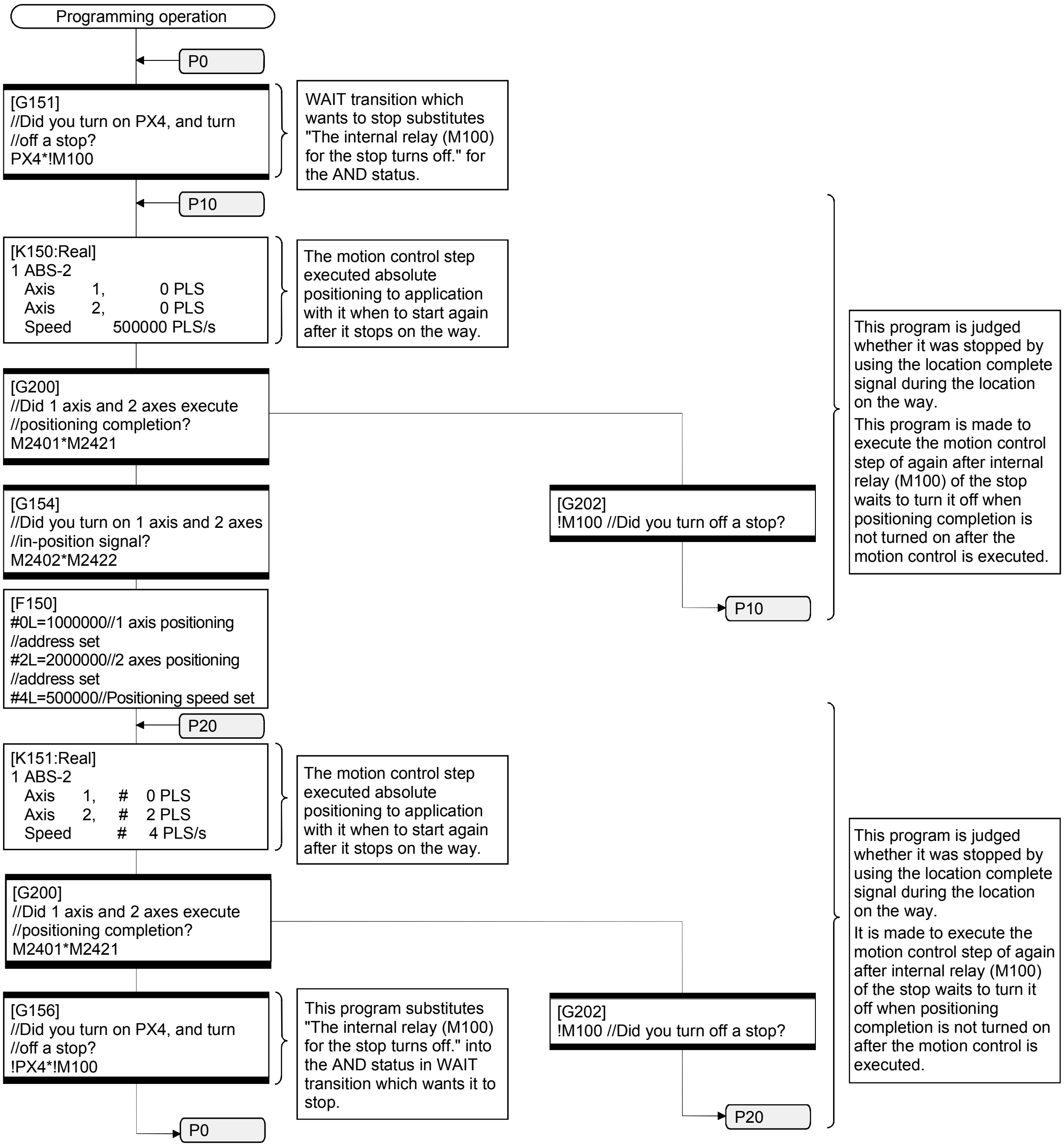
[G170]
//Did you release a stop?
// (Did a thing during servo ON and PX5
//turn off 1 axis and 2 axes?)
M2415*M2435*!PX5

[F170]
//A stop is being released stop, status.
RST M3200 //1 axis stop command OFF
RST M3220 //2 axes stop command OFF
RST M100 //Stop OFF

[F171]
//The stop is being turned on, status.
SET M100 //Stop ON
SET M3200 //1 axis stop command ON
SET M3220 //2 axes stop command ON

When servo ON and the outside input signal (PX5) for the stop are OFF, 1 axis, 2 axis stop command are turned off, and 1 axis, 2 axis continue motion control by turning off an internal relay (M100) for the stop.
It is made to turn on 1 axis, 2 axis stop command, and motion control is made to stop by turning on an internal relay (M100) for the stop, too, when either axis turns off servo or when PX5 turns it on.

(c) No.150 : Programming operation



```
[G151]
//Did you turn on PX4, and turn
//off a stop?
PX4*!M100
```

WAIT transition which wants to stop substitutes "The internal relay (M100) for the stop turns off." for the AND status.

```
[K150:Real]
1 ABS-2
   Axis      1,           0 PLS
   Axis      2,           0 PLS
   Speed        500000 PLS/s
```

The motion control step executed absolute positioning to application with it when to start again after it stops on the way.

```
[G200]
//Did 1 axis and 2 axes execute
//positioning completion?
M2401*M2421
```

```
[G154]
//Did you turn on 1 axis and 2 axes
//in-position signal?
M2402*M2422
```

```
[G202]
!M100 //Did you turn off a stop?
```

This program is judged whether it was stopped by using the location complete signal during the location on the way.

This program is made to execute the motion control step of again after internal relay (M100) of the stop waits to turn it off when positioning completion is not turned on after the motion control is executed.

```
[F150]
#0L=1000000//1 axis positioning
//address set
#2L=2000000//2 axes positioning
//address set
#4L=500000//Positioning speed set
```

```
[K151:Real]
1 ABS-2
   Axis      1,    #   0 PLS
   Axis      2,    #   2 PLS
   Speed          #    4 PLS/s
```

The motion control step executed absolute positioning to application with it when to start again after it stops on the way.

```
[G200]
//Did 1 axis and 2 axes execute
//positioning completion?
M2401*M2421
```

```
[G156]
//Did you turn on PX4, and turn
//off a stop?
!PX4*!M100
```

This program substitutes "The internal relay (M100) for the stop turns off." into the AND status in WAIT transition which wants it to stop.

```
[G202]
!M100 //Did you turn off a stop?
```

This program is judged whether it was stopped by using the location complete signal during the location on the way.

It is made to execute the motion control step of again after internal relay (M100) of the stop waits to turn it off when positioning completion is not turned on after the motion control is executed.

MEMO

WARRANTY

Please confirm the following product warranty details before using this product.

1. Gratis Warranty Term and Gratis Warranty Range

We will repair any failure or defect hereinafter referred to as "failure" in our FA equipment hereinafter referred to as the "Product" arisen during warranty period at no charge due to causes for which we are responsible through the distributor from which you purchased the Product or our service provider. However, we will charge the actual cost of dispatching our engineer for an on-site repair work on request by customer in Japan or overseas countries. We are not responsible for any on-site readjustment and/or trial run that may be required after a defective unit is repaired or replaced.

[Gratis Warranty Term]

The term of warranty for Product is thirty six (36) months after your purchase or delivery of the Product to a place designated by you or forty two (42) months from the date of manufacture whichever comes first "Warranty Period". Warranty period for repaired Product cannot exceed beyond the original warranty period before any repair work.

[Gratis Warranty Range]

(1) You are requested to conduct an initial failure diagnosis by yourself, as a general rule.
It can also be carried out by us or our service company upon your request and the actual cost will be charged. However, it will not be charged if we are responsible for the cause of the failure.

(2) This limited warranty applies only when the condition, method, environment, etc. of use are in compliance with the terms and conditions and instructions that are set forth in the instruction manual and user manual for the Product and the caution label affixed to the Product.

(3) Even during the term of warranty, the repair cost will be charged on you in the following cases;

1) A failure caused by your improper storing or handling, carelessness or negligence, etc., and a failure caused by your hardware or software problem
2) A failure caused by any alteration, etc. to the Product made on your side without our approval
3) A failure which may be regarded as avoidable, if your equipment in which the Product is incorporated is equipped with a safety device required by applicable laws and has any function or structure considered to be indispensable according to a common sense in the industry
4) A failure which may be regarded as avoidable if consumable parts designated in the instruction manual, etc. are duly maintained and replaced
5) Any replacement of consumable parts (battery, fan, etc.)
6) A failure caused by external factors such as inevitable accidents, including without limitation fire and abnormal fluctuation of voltage, and acts of God, including without limitation earthquake, lightning and natural disasters
7) A failure generated by an unforeseeable cause with a scientific technology that was not available at the time of the shipment of the Product from our company
8) Any other failures which we are not responsible for or which you acknowledge we are not responsible for

2. Onerous Repair Term after Discontinuation of Production

(1) We may accept the repair at charge for another seven (7) years after the production of the product is discontinued.
The announcement of the stop of production for each model can be seen in our Sales and Service, etc.

(2) Please note that the Product (including its spare parts) cannot be ordered after its stop of production.

3. Service in overseas countries

Our regional FA Center in overseas countries will accept the repair work of the Product; However, the terms and conditions of the repair work may differ depending on each FA Center. Please ask your local FA center for details.

4. Exclusion of Loss in Opportunity and Secondary Loss from Warranty Liability

Whether under or after the term of warranty, we assume no responsibility for any damages arisen from causes for which we are not responsible, any losses of opportunity and/or profit incurred by you due to a failure of the Product, any damages, secondary damages or compensation for accidents arisen under a specific circumstance that are foreseen or unforeseen by our company, any damages to products other than the Product, and also compensation for any replacement work, readjustment, start-up test run of local machines and the Product and any other operations conducted by you.

5. Change of Product specifications

Specifications listed in our catalogs, manuals or technical documents may be changed without notice.

6. Precautions for Choosing the Products

(1) For the use of our Motion controller, its applications should be those that may not result in a serious damage even if any failure or malfunction occurs in Motion controller, and a backup or fail-safe function should operate on an external system to Motion controller when any failure or malfunction occurs.

(2) Our Motion controller is designed and manufactured as a general purpose product for use at general industries. Therefore, applications substantially influential on the public interest for such as atomic power plants and other power plants of electric power companies, and also which require a special quality assurance system, including applications for railway companies and government or public offices are not recommended, and we assume no responsibility for any failure caused by these applications when used.

In addition, applications which may be substantially influential to human lives or properties for such as airlines, medical treatments, railway service, incineration and fuel systems, man-operated material handling equipment, entertainment machines, safety machines, etc. are not recommended, and we assume no responsibility for any failure caused by these applications when used.

We will review the acceptability of the abovementioned applications, if you agree not to require a specific quality for a specific application. Please contact us for consultation.

MOTION CONTROLLER Qseries
SV13/SV22 (Motion SFC) Programming Manual
(Q173CPU(N)/Q172CPU(N))

MITSUBISHI ELECTRIC CORPORATION

HEAD OFFICE : TOKYO BUILDING, 2-7-3 MARUNOUCHI, CHIYODA-KU, TOKYO 100-8310, JAPAN

MODEL	Q173-P-SV13/22-SFC-E
MODEL CODE	1XB781
IB(NA)-0300042-D(1004)MEE	

When exported from Japan, this manual does not require application to the Ministry of Economy, Trade and Industry for service transaction permission.

Specifications subject to change without notice.